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ABSTRACT

This set of nine teacher-prepared Learning Activity Packages (LAPs) for individualized instruction in physical science covers the topics of scientific equipment and procedures; measure of time, length, area, and volume; water; oxygen and oxidation; atmospheric pressure; motion; machines; carbon; and light and sound. Each unit contains a rationale for the material; a list of behavioral objectives for the unit; a list of resources including texts, reading assignments, specified problems, handouts, tape recordings, filmstrips, demonstrations, lab experiments, and science activities; a problem set for student self-evaluation; suggestion for advanced study; and references. (DT)

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U S DEPARTMENT OF HEALTH,
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ACTIVITY PACKAGE

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INTRODUCTION TO GENERAL SCIENCE

Ninety Six High School
Ninety Six, S.C.

SCIENCE 92

018 125

REVIEWED BY

LAP NUMBER 1

WRITTEN BY G. J. Williams

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R A T I O N A L E

Introduction to General Science

You are about to enter into a very interesting adventure -- the Study of General Science.

This adventure will take many paths, all leading to a better understanding of nature and the ever changing world in which we live.

[illegible] will be the basic foundation for our [illegible].

[illegible] become familiar with the equipment and basic procedures necessary for the study of science.

[illegible] we will deal with some simple mathematics in science.

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Introduction

Throughout our endeavors you will encounter certain abbreviations. You will find it very helpful to learn these abbreviations.

General

1. SD - Science Department
2. LIB- Library
3. RS- Resource Sheet
4. WS- Worksheet
5. WTT- Wollensak Teaching Tape
6. T- Transparency

You will find the interpretation of the abbreviation for the book used preceding each section under the title resources. Refer to this key and the resource key if you have difficulty at first, but as you learn the abbreviations your problems will be minimized.

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Introduction to General Science

Section I

Equipment and scientific procedures:

Resources for section I

Books

1. SD-EPS- Exploring Physical Science by Thurber and Kilburn pp. 470-474
2. SD PS (W-A-T) Physical Science (Work-A-Text) by Milton Gallembo pp. 4-5 and p. 20.
3. SD WDE- World Book Encyclopedia vol 3 pp. 322-324 vol 19 pp. 228-22[illegible]
4. SD The Dictionary

Handouts

1. Resource Sheet- Science Tools
2. List of instruments to determine use

Experiment:

Demonstrations- Laborative skills

Lectures:

1. "Introduction to the Study of Science"
2. "Scientific Tools and Their Uses"

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Section I

Scientific equipment and procedures

Behavioral Objective I

1. After using the prescribed resources and completing the given activities you will be able to list the name, description, use and safety measures for fifteen given pieces of science equipment. This is the equipment that will be found in the laboratory and we will use it during the school year.

Activities.

1. Study the displayed equipment and relate the names with its description.
2. Study the diagrams illustrating the equipment which will be submitted to you. (Make a sketch if necessary- The illustrations will be returned.)
3. Use the following resources SD-PS (W-A-T) pp. 4-5 (Study the illustrations.)

   SD-EPS - pp. 471-474 Try to name as many of the displayed equipment as you can.

   SD-PS p. 9 complete questions (2) a,b,c,d,e,f,g,h,i, and J
4. Record notes from the chalk board and listen to the lecture on "Scientific Tools and Their Uses"
5. Select 15 out of a list of 25 given instruments and state for what they are used. (Consult a dictionary) This is practical scientific equipment not necessarily found in Lab, but useful.
6. State five reasons why scientific equipment is important (consult the WBE - pp. 228-229 vol 10.

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Behavioral Objective II

After completing the prescribed activities you will be able to perform the following simple laborative skills; using the apparatus you learned about in Objective I.

(a) cut, bend and polish glass tubing

(b) collect a gas under water

(c) measure using a graduated cylinder

(d) weigh objects using a platform balance

(e) filter solutions using filter paper

(f) test solutions using litmus paper

(g) glass tubing into a stopper

Activities.

1. Read the information given in your textbook EPS -pp 470-474
2. Observe the demonstration for each of the laborative skills which will be performed by your teacher. (Record notes)
3. Select a partner and practice performing the laborative skills.
4. Study guides, diagrams, illustrations, information and procedures as listed in the following resources.

SD-EPS pp. 470-474

SD - Resource Sheets (Complete Activities)

1. Using a Graduated cylinder
2. Using a platform balance
3. Filtering a solution
4. Testing with litmus paper

LIB - MBE Vol. 3 pp. 322 d

Self-Evaluation **Section I**

1. Supply the correct names for the scientific equipment which will be on display.

1	6	11
2	7	12
3	8	13
4	9	14
5	10	15

2. Name the equipment you would use for the following:

1._____ crush solids

2._____ weigh objects

3._____ hold a hot test tube

4._____ heat objects strongly

5._____ measure liquids

6._____ condense liquids

7._____ evaporate liquids

8._____ filter solutions

9._____ collect a gas

10._____ lift a hot beaker

3. Briefly explain how you would perform the following operations:

1. cut glass tubing

2. filter solutions

3. measure using a graduated cylinder

4. Perform the following operations:

   1. Determine the weight of a given item using the platform balance. answer_____

   2. Measure a given amount of liquid using the graduated cylinder. answer_____

   3. Set up the apparatus for collecting a gas under water and explain how each part functions.

Advanced Study

1. Prepare a report on any piece of practice equipment which interests you most. (ex) Barometer, geiger counter, etc.
2. Contrast the difference in properties between common household glassware and laboratory glassware.
3. Make a chart neatly displaying cut-outs of some scientific equipment found in the laboratory.
4. Prepare a poster displaying the names of some science equipment and state its use.
5. Make a chart illustrating some safety techniques in the laboratory.
6. Demonstrate to the class how to correctly perform any three basic laboratory skills.

Resources:

Books and teaching tapes

SD-EPS Exploring Physical Science by Thurber and Kilburn

LIB - WBE World Book Encyclopedia p. 195 and p. 104

SD SKF Science: A Key To The Future by Barnard, Stendler, Spock, and Edwards pp. 252-254

SD MPS Modern Physical Science by Brooks, Tracy, Troop and Friedl pp. 248-252

SD PW The Physical World by Brinckerhoff, Cross, Watson and Brandwein pp. 255-256

LIB - WTT Wollensak Teaching Tape

1. Temperature Conversion Centigrade to Fahrenheit C-51
2. Temperature Conversion Fahrenheit to Centigrade C-52

Section II

Temperature and Its Measurement

Behavioral Objective I

I. After completing the prescribed activities you will be able to state the significance, name parts, read, and record readings from a fahrenheit and centigrade thermometer with an accuracy of ± 2 degrees.

Activities:

1. Using the resource SKF p. 254 state the basic difference in scales between the fahrenheit and centigrade thermometers.
2. Record the difference in the boiling and freezing point of water on each scale.
3. Observe a thermometer and list the name of the three basic parts and their use.
4. Find out why they use mercury and alcohol in a thermometer in preference to water.
5. Observe the teachers demonstration on how to use and read a thermometer. (Record notes)
6. Make sketches which indicate different given thermometer readings.
7. Read and record the temperature of given liquids with an accuracy of ± 2 degrees.
8. Given diagrams illustrating thermometers record the indicated reading._____
9. Using resource MPS pp. 252-253 answer questions 3.4.5,6,7 and 9.

Resources: Section II Objective I

1. SD - MPS pp. 248-251 study
2. SD - PW pp. 255-256 study
3. SD - MPS pp. 248-252 Activity
4. SD - SKF pp. 252-254 study
5. SD - EPS pp. 19-20 study
6. SD - PS (W-A-T) pp. 110-111 study

Other Resources:

Handouts Thermometer illustrations

Lecture and Demonstrations

"How To Use a Thermometer"

Filmstrip

(LIB) How We Measure Heat

Section II

Objective II

You may find yourself in a situation where you may have one type of thermometer (ex. centigrade and your record may require you to record your readings in a different scale(ex. fahrenheit)

After completing the following activities you will be able to change fahrenheit readings to centigrade readings and centigrade readings to fahrenheit readings.

Activities:

1. Review the boiling and freezing points of water on each scale. (notes)
2. Find the basic formula for converting scales PW pp. 255-256

   (It is necessary that you learn these formulas)
3. Listen to the following Wollensak Teaching Tapes:

   Temperature Conversion:

   1. Fahrenheit to Centigrade (complete worksheet) LIB C-51
   2. Centigrade to Fahrenheit (complete worksheet) LIB C-52
4. Observe and record notes from the teachers lecture on converting scales. (Practice on your own)
5. Complete the given scale conversion which will be submitted to you. (These will be passed in and graded)
6. Select a partner- one use a centigrade thermometer and the other use a fahrenheit thermometer(Be Careful Not To Break the Thermometers) Get some tap water from the faucet in a beaker. Each of you at the same time place your thermometers in the water. After two minutes each of you at the same time record the readings from your thermometers. After you obtain your reading convert it to the opposite scale for example if you have centigrade change your reading to fahrenheit, if you have fahrenheit change your reading to centigrade.

Results?_____

Conclusion?_____

Resources:

Books

SD - PW pp. 255-256

SD - EPS p. 486

SD - PS (W-A-T) p. 110

Handouts:

1. Basic Formulas for Scale Conversions
2. Readings to Convert From One Scale to the Other

Demonstration and Lecture

How to Convert Temperature Scales

Experiment

1. Comparing scale readings on different thermometers

Teaching Tapes

1. Fahrenheit to Centigrade LIB C-51
2. Centigrade to Fahrenheit LIB C-52

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Self-Evaluation

1. Construct a thermometer which will indicate each of the following readings:

   (a) 5^{o} C (a) (b) (c)

   (b) 12^{o} C

   (c) 15^{o} C

2. Record the following thermometer reading.

   answer_____

3. Convert the following C^{o} readings to F^{o}.

   (a) 100^{o} C = _____ ^{o} F

   (b) 15^{o} C = _____ ^{o} F

4. Convert the following F^{o} readings to C^{o}.

   (a) 95^{o} F = _____ ^{o} C

   (b) 86^{o} F = _____ ^{o} C

5. What formula is necessary to change F^{o} to C^{o}_____

   C^{o} to F^{o} _____

Section III

Graphing and Interpreting Data

Resources:

Books

SD - EPS Exploring Physical Science by Thurber and Kilburn pp. 9-16

LIB - WBE - World Book Encyclopedia vol. 8 p. 314

Others

Transparency- Line Graph

Lecture

Graphing and Interpreting Data

Handouts

1. Data to Graph
2. Data to Interpret

Resource Sheet

1. Diagrams of different graphs

Section III

Graphing and Interpreting Data

Behavioral Objective I

After completing the following activities you will be able to state the significance of graphs in science and how to plot simple data on a graph.

Activities

1. Bring some graph paper to class and learn the difference between the vertical and the horizontal axis.
2. With a given set of numbers practice constructing the graph with the proper horizontal and vertical axis.
3. With a given set of numbers practice selecting the best

interval to plot data.

4. Observe and record notes from the lecture on preparations necessary for graphing data, and how to plot a graph.
5. Practice plotting given data on graph paper.
6. Complete the given worksheet on data to plot on a graph.

Behaviorial Objective 2

You will after completing the following activities learn how to interpret data as a result of a graph.

Activities:

1. Review information you have received on how to plot a graph and the difference between the horizontal and vertical axis.
2. The teacher will demonstrate how to interpret data from a given graph.
3. Using the chart at the bottom on page 11 in the resource EPS, see if you can answer the following questions.
   (a) How much air was displaced at 30^{o} C._____
   (b) .75 mm of air was displaced at what temperature?_____
   (c) What is plotted on the vertical axis of the graph?
   (d) What is plotted on the horizontal axis of the graph?
4. Practice interpreting the graph at the top to the right of page 15 in the resource EPS.
5. Interpret a given graph(you will pass this activity into be graded)

Resources:

Books

SE-EPS pp. 15-16 and pp. 482-484

LIB-WBE pp. 318 vol. 8

Transparency:

1. The Line Graph

Filmstrip:

Tape:

Self-Evaluation **Section III**

1. Construct a graph (or use graph paper) and plot the following data. (The effects of heat on the volume of a liquid)

HEAT	VOLUME OF THE LIQUID
10^{0} C	10 ml
15^{0} C	20 ml
25^{0} C	40 ml
20^{0} C	30 ml
30^{0} C	50 ml

Show the graph here:

From your graph answer the following questions:

1. How did a rise in temperature effect the volume of the liquid?_____

2. At 40^{0} C what would probably be the volume?_____

   Why?_____

Advanced Study

1. Bring in cut outs of as many different graphs as you can find and classify them according to the area in which the graph is used. Example- Science, Economy, Business, etc.

2. Bring in a picture of a graph accompanied by a sheet with your interpretation of the Graph.

3. Construct on a poster a display of several different kinds of graphs.

4. Make a write-up on why graphs are important in the area of science.

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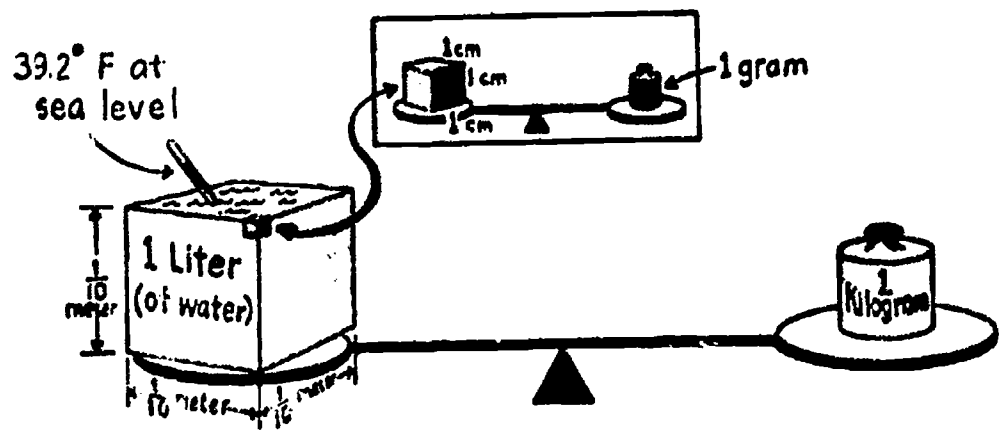
LEARNING ACTIVITY PACKAGE



Measurements In Science

Ninety Six High School
Ninety Six, S.C.

Physical Science 92

REVIEWED BY

LAP NUMBER 2

WRITTEN BY G. J. Williams

R A T I O N A L E

Our last LAP dealt with the basic tools and procedures in science.

In this LAP, we will consider measurement in relation to science. Many problems of science require definite answers to such questions as "How long?", "How much Time?" "How Fast?" and "How much space?"

This adventure will enable you to better understand the quantitative relationship between mathematics and science.

Our next LAP will deal with a study of the elements.

SECTION I - Resources

SD - The Dictionary

SD - (H-A-W) - T - The and How and Why Book of Time by Gene Liberty

SD - MPS - Modern Physical Science by Brooks, Tracy, Tropp and Friedl

LIB - WBE - World Book Encyclopedia, Vol. 3

LIB - WBE - World Book Encyclopedia, Vol 17

LIB - WBL - World Book Encyclopedia, Vol. 21

SD SKF - Science:A Key to the Future by Barnard, Stendler, Spock and Edwards

LIB - Films - (1) The Moon

(2) The Earth

LIB - Study prints

(1) Phases of the Moon

(2) Day and Night

(3) The Seasons

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Behavioral Objectives

After completing the following activities you will be able to:

1. State how the following are measured in relation to time:

   a. second
   b. minute
   c. hour
   d. day
   e. week
   f. month
   g. year

2. State the cause of the following in relation to time:

   a. day and night
   b. seasons (summer, winter, etc.)
   c. year
   d. leap year
   e. equinox
   f. Daylight Savings Time

ACTIVITIES

1. Define these terms related to the measurement of time. (dictionary)

   a. minute
   b. week
   c. month
   d. year
   e. calendar
   f. hour
   g. light year
   h. equinox
   i. day
   j. night

2. State in writing and pass in to be graded the cause of the following:

   a. day and night
   b. seasons (of the year)
   c. year
   d. leap year
   e. equinox
   f. Daylight Savings Time

   (Good resources to use here are LIB - WBE 1. Vol. 5 pp. 46
   2. Vol. 17 pp. 218
   3. Vol. 21 pp. 460
   SD-(H-A-W)T - pp. 8-15, 21-28.
   SD-MPS - pp. 537-544.
   SD-SKF - pp. 288-292.

3. Complete the worksheet on time which will be submitted to you. (The World Book Encyclopedia will be helpful)

4. Using the MPS resource pp. 549-550, answer the following questions 2, 3, 4, 5, and 10.

Behavioral Objectives

3. State how our present calendar is organized in relation to time.

ACTIVITIES

1. Using resource MPS pp. 542-543 read and study the history of calendars, also consider the H-A-W-T - pp. 10-15.

2. Write a brief summary on how our calendar is organized, include name of months and number of days for each month and some of the problems encountered in organizing the calendar.

3. Discuss why a year is made up of 365¼ days and why every four years we have 366 days - (a leap year).

4. State the role the moon plays in reference to the number of days in a month.

RESOURCES FOR OBJECTIVE 3

SD-MPS - pp. 542-543
SD-H-A-W-T - pp. 7 - 20
SD-SKF - pp. 294-295
LIB WBE - Vol. 3 pp. 26-29 (Calendar)

Handouts: Model of calendar to complete

Behavioral Objectives

4. State how the following instruments are used to measure time.

a. sundial
b. clock
c. radiocarbon
d. speedometer
e. anemometer
f. pendulum
g. hourglass
h. water clock
i. sand glass

ACTIVITIES

1. List and define each of the instruments listed above.

2. State what each of the above instruments are used to measure.

3. Select any two of the above instruments and prepare a written report on its use and operation.

Resources for Objective 4

LIB - WBE Vol. pp.
LIB - WBE Vol. pp.
LIB - WBE Vol. pp.

SD - Dictionary
SD - H-A-W-T pp. 32-42

SELF-EVALUATION I

I. COMPLETE THE FOLLOWING STATEMENTS.

1. It takes _____ seconds to make a minute.

2. It takes _____ minutes to make an hour.

3. It takes _____ hours to make a day.

4. It takes _____ days to make a week.

5. It takes _____ months to make a year.

6. It takes _____ days to make a year.

7. It takes _____ days to make a leap year.

II. Briefly explain what causes the following phenomena.

1. day and night

2. a year

3. leap year

4. equinox

III. Differentiate between standard time and daylight savings time.

IV. State the significance of daylight savings time.

SELF-EVALUATION I (cont')

V. What is the name of the calendar that we use today?

VI. What were some of the problems encountered in organizing the earlier calendars?

VII. Explain why we have leap year every four years.

VIII. Name four instruments that are used to measure time and state their particular use.

SECTION I - Advanced Study

1. Make a report using five different references on the measurement of time.

2. Do some research on what a radiocarbon clock is and what it is used to measure.

3. Do some research on how an atomic clock works.

4. Explain how the time system is used in the armed services.

5. Write a report and include some information about each of the following:
   a. Standard time zones
   b. Time center for the world
   c. Standard times in different cities

SECTION II

Measurement of Space
(Length, Volume, and Area)

RESOURCES

SD-SKF - Science: A Key to the Future, pp. 10-13 and p. 16 by Barnard Stendler, Spock, and Edwards.

SD-PW - The Physical World by Brinckerhoff, Cross, Watson and Brandwein.

SD-PS (W-A-T) Physical Science by Atho Perkins.

SD-MPS - Modern Physical Science by Brooks, Tracy, Tropp, and Friedl.

Chart: Calculating Volume, Area, and Density

Wollensak Teaching Tape - The Metric System (Complete worksheet)

SECTION II

Measurement of Space

Behavioral Objectives

After completing the following activities, you will be able to:

1. Calculate the volume of rectangular-shaped objects and determine the volume for irregular shaped objects.

Activities for Objective 1

1. Find the difference between regular and irregular shaped objects and the meaning of volume. (Dictionary) on Modern Physical Science
2. Construct a rectangular shaped diagram and designate the length, width, and height positions. (Consult MPS pp. 8-9)
3. Write the basic formula which is used to calculate the volume of a rectangular shaped object (MPS pp. 8-9)(PS (W-A-T) p. 13)
4. Study the sample problem at the bottom of pp. 8-9 in the MPS resource.
5. Record notes from the lecture and demonstration on "How to determine the volume of a rectangular shaped object. (Teacher)
6. Complete the assigned problems and pass in to be graded. (These will be submitted to you)
7. Prepare a write-up and demonstrate how to determine the volume of irregular shaped objects. (MPS - p. 9 and PS (W-A-T) p. 13)
8. Read p. 9 of the MPS textbook and study the diagram which illustrates how to determine the volume of irregular shaped objects.
9. Determine the volume for given irregular shaped objects. (Pass a record of your answers in to be graded).

BEHAVIORAL OBjectives

2. Measure length and calculate the area for given objects in both the metric and English systems of measurement.

Activities for Objective 2

(You will need a meter stick or ruler for the following activities)

1. Measure the length of your desk with your meter stick. Make two separate measurements. Write your results and record the average of your two measurements. (Metric system measurement)

#1 _____ cm #2 _____ cm _____ avg.

Activities for Objective 2 (cont.)

2. Repeat the preceding experiment with a ruler.

   Measurement #1_____ in. #2_____in.

   Average _____ in.

   (For these activities, consult page 5 of MPS)

3. Complete the activities listed on measurements with a meter stick.

4. To determine the area of an object you must multiply the length X width. Learn this formula: A = L x W.

5. Construct a rectangular shaped diagram - determine the position of the length and width. (PS W-A-T) pp. 12-13.

6. Find the units which are used to express volume and area. MPS pp. 3-9.

7. Determine the area for a given object. (This will be submitted for credit).

8. Review - Experiment - take a rectangular shaped object (Shoe box).

   Determine (a) length #1_____ #2_____ average_____

   (b) length #1_____ #2_____ average____

   (c) length #1_____ #2_____ average____

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EXPERIMENT

"Measuring With A Meter Stick"

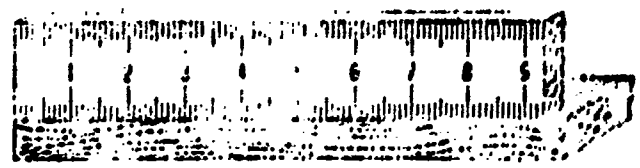

Fig.1-1

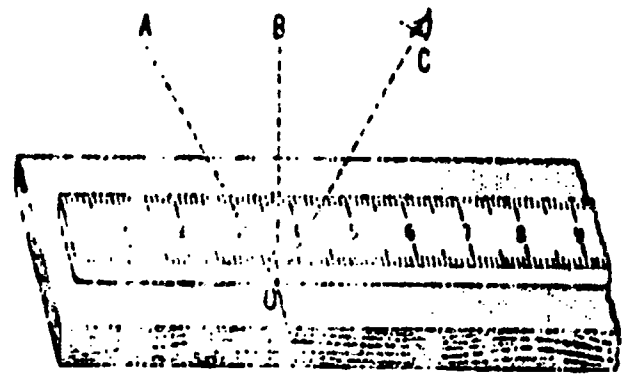

Fig. 1-2

In making measurements of length with a meter stick, the meter stick should be placed on the edge as shown in figure 1-1. If the meter stick lies flat on a table, as shown in figure 1-2, the scale is so far from the table that it is possible to make a variety of readings. If you look along the line AO, the reading of the line on the table appears to be at the 3.3 cm division of the meter stick. If you look along the line CO, the reading now appears to be 3.7 cm. Both readings are in error because of parallax. Parallax is apparent movement of the line, with respect to the markings on the meter stick, which occurs as the eye of the observer moves from A to C. The correct reading, 3.5 cm, is obtained only when one looks along the line BO. Errors due to parallax are avoided if the meter stick is placed on its edge when making measurements.

PROCEDURE IS ON THE BACK OF THIS PAGE.

EXPERIMENT (Cont.)

"Measuring With The Meter Stick"

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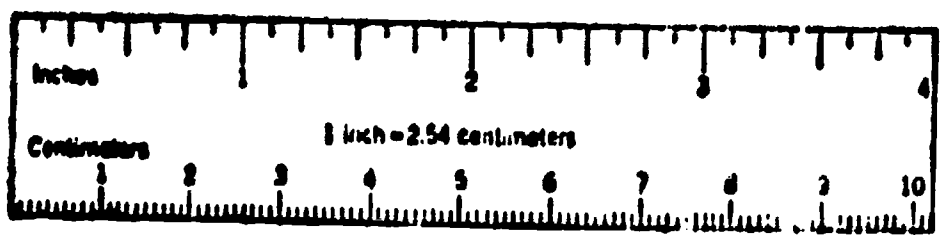
PROCEDURE:

Examine your ruler and determine which side is marked off in meter units.



--ENGLISH SYSTEM UNITS

--METRIC SYSTEM UNITS

Using the side marked off in metric units, measure and recored the length of the following objects:

a. Across the center of your desk._____.

b. Length of your textbook _____.

c. Length of your notebook _____.

d. length of the following line segments:

1. _____ ANSWER_____

2. _____ ANSWER_____

3. _____ ANSWER_____

e. Construct line segments for the following lengths:

1. 2 cm.

2. 3.3 cm.

3. 1.5 cm.

SELF-EVALUATION II

1. Take out your ruler. Draw a line

   10 cm. long

   5 in. long

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2. Complete this chart.

OBJECT	LENGTH	X	WIDTH	=	AREA
1. BOOK	#1		#1		
	#2		#2		Average
2. Soda Box	#1		#1		
	#2		#2		Average
3. Shoe Box	#1		#1		
	#2		#2		Average
4. Block of Wood	#1		#1		
	#2		#2		Average

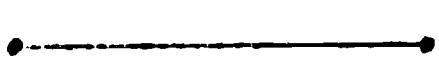
3. Differentiate between a regular shaped object and an irregular shaped object.

4. Define volume.

5. Complete this chart.

OBJECT	LENGTH X	WIDTH X	HEIGHT =	VOLUME
Book	#1	#1	#1	
	#2	#2	#2	Average
Soda	#1	#1	#1	
	#2	#2	#2	Average
Shoe Box	#1	#1	#1	
	#2	#2	#2	Average

6. Measure these line segments.



= #1 _____ inches

#2 _____ inches

Average _____ inches

= #1 _____ cm

#2 _____ cm

Average _____ cm

ADVANCED STUDY

1. Demonstrate how you can determine the <u>area</u> for the following.

   (a) a circle
   (b) a triangle
   (c) a parallelogram

2. Demonstrate how you can determine the volume of:

   (a) a cylinder
   (b) a sphere
   (c) a pyramid

3. Make a poster displaying how to solve problems related to volume and/or area. Include diagram, formula, and solution for solving the problem(s).

4. Make a list of ten practical applications for length, volume, and/or area.

   Ex.- To determine how deep a pool is you would need to know (volume, and/or area, length)?

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LEARNING ACTIVITY PACKAGE

THE NATURE OF WATER

Ninety Six High School
Ninety Six, S.C.

PHYSICAL SCIENCE 92

REVIEWED BY

LAP NUMBER 3

WRITTEN BY G. J. Williams

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R A T I O N A L E

Some aboard for another adventure. We have just completed our study of measurement, now let's get on to some more [illegible]. Let's start with a very [illegible] the study of water.

[illegible] direct our attention to the [illegible] properties of water [illegible] solutions.

In our next LAP we will venture into the study of oxygen and oxidation.

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Section I

BEHAVIORAL OBJECTIVE I Part A

After completing the following activities you will be able to recognize some of the properties of water.

1. Read pages 18-35 in your EPS textbook.
2. State the boiling and freezing points on a thermometer- EPS p. 18.
3. Perform the experiment - The Effect of Dissolved Substances- EPS page 20 and state the effect that dissolved substances have on the boiling point of water. (Does it make the boiling point higher or lower?)
4. Perform the experiment on The Effect of Reduced Pressure, p. 20 EPS State the effect that reduced pressure has on the boiling point of water. (Does reduced pressure make the boiling point of water higher or lower?)
5. Perform the experiment on Temperature and Diffusion p. 25 in EPS State how temperature effects diffusion. (Normally does an increase or decrease in temperature make things dissolve faster?)
6. Read page 25 in EPS list the names of the three basic states of matter and state how the molecules are believed to be arranged in each state of matter. (Example- in the gaseous state of matter the molecules are believed to be spreaded randomly about.)
7. Study the nature of drops of water by performing the experiment - The Nature of Drops and answering the questions within the experiment.

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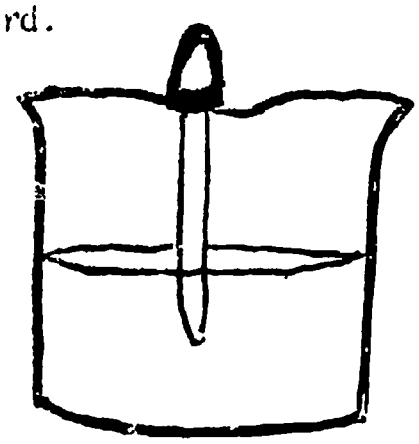
The Nature of Drops Play tape 2 6.4

1. With a clean dropper, place several water droplets of different sizes on the wax paper. One droplet should be as small as possible, and the largest should be many times that size. Place various sized droplets on other surfaces, such as a piece of plastic sheeting, a table top, and a piece of paper towel.
2. Observe differences in the shapes of the drops, beginning with the smallest. Make sketches and record your observations.
3. Place 2 small drops of water on the plastic sheeting as close to each other as possible. Determine how close the two drops must be to each other before they interact. Record. What happens to the 2 drops when they touch?
4. Touch some of the droplets with the tip of a clean toothpick. Observe and record any change in appearance of the drops.
5. Dip the tip of a clean toothpick into the soap solution. Touch a water drop with this toothpick. Repeat this procedure several times with other drops. Record your observations.



6. Carefully introduce a few drops of water into a beaker about 2/3 full of a clear oil. Describe the shape of these drops. Can you explain why they have this shape? What happens to these drops? Slowly squeeze the dropper until all the water has been forced into vegetable oil. Do all the drops move at the same speed? Record.
7. Follow the steps in procedure 6 again, but this time use a dropper full of clear oil and a beaker of water. Describe and explain the results.

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Experiment (cont.)

A. Why do you think drops take the shapes you observed?

B. What could make the shape of drops change with increasing size?

C. Does the material or surface on which a droplet is placed affect the droplet in any way?

D. What statement can you make about the behavior of 2 water drops when they touch?

E. How did the shape of the droplets change when touched with a clean toothpick? With a toothpick dipped into the soap solution? Explain your answers.

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In this section you will study the nature of solutions.

ACTIVITIES

1. Read pages 26-33 in your EPS. (Your textbook)
2. Define the following terms.
   1. Dissolve
   2. Solute
   3. Solvent
   4. Solution
   5. Concentrated
   6. Dilute
   7. Saturated
   8. Diffusion
3. Briefly explain why things dissolve. EPS 26
4. Perform the experiment on page 26. Diffusion from Crystals. Explain what happens and why.
5. List four ways you can make things dissolve faster p. 27 EPS.
6. What effect does temperature have on the dissolving process? P. 27 EPS. (Perform the experiment if necessary)
7. Read pages 30-33. EPS.
8. Perform the experiments necessary for you to be able to state the following concepts. EPS pp. 30-33.
   1. What effect does the following have on gases in solution?
      1. Stirring
      2. Temperature
      3. Pressure
      4. Adding solutes
9. Explain how you can determine how much gas is in a soda pop. (Do the experiment if necessary p. 31 EPS)
10. Perform the experiments on pages 32-33 in EPS it is necessary for you to answer the following concepts.
    1. How can you drive gases from tap water (What is tap water)? p. 32 EPS.
    2. How can you collect gases from water? EPS p. 33

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3. How can you <u>test</u> for the presence of oxygen? (How will you know if oxygen is present?)

4. How can you test for the presence of carbon dioxide? (How will you know if carbon dioxide is present?)

Additional Resources for Section I

1. Modern Physical Science 71-82

Filmstrip:

Water and Its Uses

Pamphlet

"What Is Water"

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1. State the boiling and freezing points of water on the

   fahrenheit scale bp._____ frp._____

   centigrade scale bp._____ frp._____

2. Generally does dissolving substances in a solution make the boiling point higher or lower?_____

3. Will water boil at a higher or lower temperature under reduced pressure?

   _____

4. Why will sugar dissolve faster in hot tea than cold tea?_____.

5. What effect does temperature have on the dissolving process?

6. Water can exist in all three states of matter, what are they?

   _____, _____ and _____

7. Classify the state of matter according to the nature of the molecules.

   A. The molecules are scattered widely about.

   B. The molecules are in a fixed position and they are close together.

   C. The molecules are not close together but are not so randomly scattered.

   1. solid_____

   2. liquid_____

   3. gas_____

8. Briefly summarize what you learned from the experiment on the nature of drops. (What did you learn by doing the experiment?)

9. How can you test for the presence of? 1. oxygen 2. carbon dioxide

10. How do you know when the following gases are present?

    1. oxygen 2. carbon dioxide

11. Identify the solute, solvent and solution.

    Salt + water ——→ Salty water

    _____ _____

Self Evaluation (cont.)

12. How does an increase in temperature effect gases in solution?_____

13. How does reduced pressure effect the boiling point of water?

_____

14. How can you drive gases from water?

15. What two gases make up water? _____ and _____

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1. Prepare a report on the general nature of water.
2. Perform an experiment which will prove that the water we drink at school is not 100% pure. (Check with your teacher here)
3. Make a display which shows some of the ways we use water.
4. Make a poster which displays the harmfulness of polluting water.
5. Make a diagram which illustrates how water can be purified.
6. Demonstrate to the class one or more of the following experiments from pages 44-45 in EPS.
   a. 10 p. 44 EPS
   b. 13 p. 45 EPS
   c. 14 p. 45 EPS
   d. 15 p. 45 EPS
7. Prepare a bulletin board exhibit of pictures showing the uses of water as a chemical.
8. Set up a demonstration of diffusion by suspending a tea bag in a large jar of water. (Explain scientifically what happens)
9. Make a chart of a pressure cooker and show its parts and the way it operates and the significance for using it.
10. Make an exhibit of substances that dissolve easily in water together with bottles of the solutions so produced.

Section II

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BEHAVIORAL OBJECTIVE I Part A

Upon completing the following activities, you will be able to identify, name, dehydrate and hydrate given hydrated crystals.

ACTIVITIES

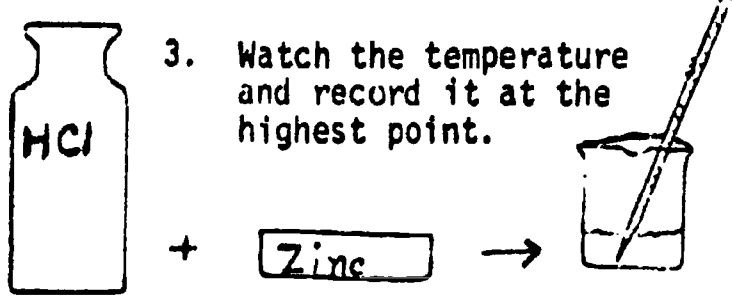
1. Read EPS pp. 34-36. (Your Textbook)
2. Perform the following experiment and answer the questions stated within the experiment- Perform part 6, 7 A and B.

E X P E R I M E N T

...of energy in chemical reactions. 6.12

...time there is a change in matter there is a change in energy. ...the energy change is noticable, as in the repid combining of ... with oxygen(burning.) Sometimes the energy change is hardly ...ble. Only by careful investigation and measurement can ...detect the energy changes in a green leaf that is converting ...ss from the environment into food.

1. Place about 1 gram of mossy zinc in a 250 ml beaker. Place a thermometer in the beaker and add enough water to cover the bulb of the thermometer. Record the temperature.
2. Now add about 5 ml of dilute hydrochloric acid (HCL) and stir the mixture carefully. Bubbles form. Put a glowing splint near the top of the beaker. What gas is given off?



3. Watch the temperature and record it at the highest point.
4. Add 50 ml of HCL to a beaker. Record the temperature.
5. Add 50 ml NaOH. Stir and record temperature
6. Place a small amount of bluestone or copper sulfate in a clean Pyrex test tube. Place the tube in a holder, and heat until the bluestone turns white. Allow the tube to cool completely.
7. Hold the tube containing the white material exactly as shown. Slowly add water. drop by drop, until a definite color change occurs. Note anything that happens as you add the water.

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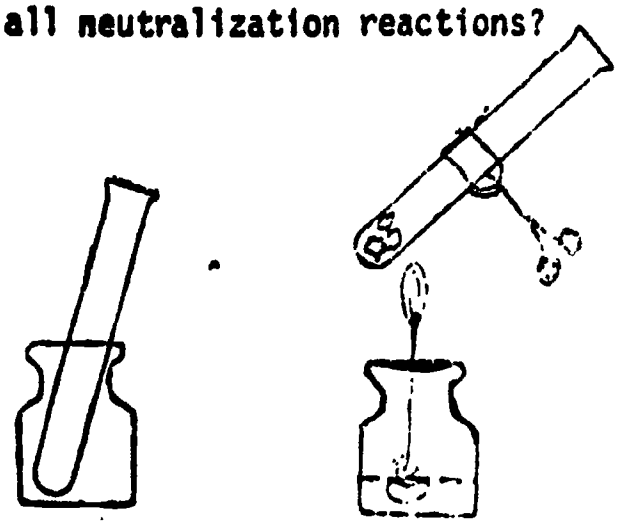
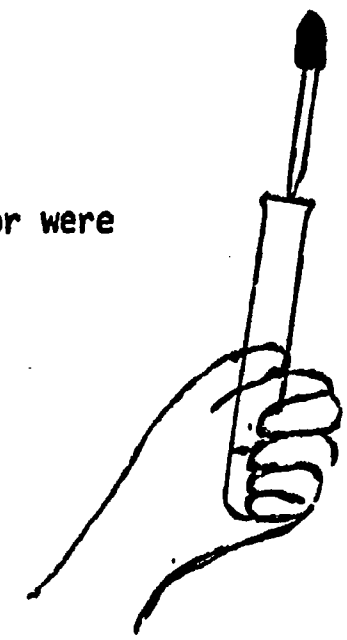
A. In addition to a change in color, another kind of change occurred. Describe this change.

B. What was given off in all of these activities?

C. Do all neutralization reactions give off heat?

D. Which of these reactions was a neutralization reaction or were they all neutralization reactions?





3. Name five other crystals which contains water of hydration other then copper sulfate.

1. 3. 5.

2. 4.

4. Differentiate between hydrating and dehydrating crystals.

Hydrating_____

Dehydrating_____

Section II

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BEHAVIORAL OBJECTIVE I Part B

Upon completing the following activities you will be able to identify, name, test and state common properties for some acids, bases and salts.

ACTIVITIES

I. State the meaning for the following terms.

1. Acid 2. base 3. salt 4. litmus paper

2. Read pages 37-43 in the EPS book.

3. Perform the experiment listed on page 37 in the EPS textbook "Testing Solutions" and complete the chart at the bottom of page 37. Classify the listed liquids as acid, base or neutral after testing each liquid, using litmus paper.

4. Complete the following experiment and answer the questions within the experiment.

E X P E R I M E N T

Mystery Solutions 6.8

A. Get a vial of solution "X" from your teacher. Determine whether it is tap water or some chemical solution other than tap water.

I'm sure you have many questions - I will guess at some of your questions and give you some answers to guide you.

1.	Can I taste it?	No. It may be poison.
2.	Will it hurt me if I spill it on my skin?	No.
3.	Will it stain my clothers?	Probably not.
4.	Can I water my plants with it?	If you wish.
5.	Can I have more if I need it?	Yes. Tell me the number.
6.	Can I freeze it?	Yes
7.	Can I give some to my dog	Please don't.
8.	Can I use books for help?	Yes.

B. One way to find out about an unkrown solution is to test it with an indicator and see if it is acid, base or neutral.

Experiment (cont.)

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Boiled red cabbage makes a good indicator. Drain off the dark juice and pout it into 3 small jars.

A. add water to jar 1.

B. add vinegar to jar 2 (an acid)

C. add ammonia (a base) to jar 3

C. What changes did you observe in these jars.

D. Could you test your unknown solution with cabbage juice? .

E. would this one test be enough to show that you do or do not have [illegible] in your vial?

Indicators are used that are in the form of paper called litmus. If you would like to test the acidity or alkanlinity of substances at school or at home, ask your teacher for some of this paper. You may want to make your own indicator paper by soaking paper towel in red cabbage juice.

5. Perform the experiments under the following topics in the EPS book. pp. 38

1. Acid, Base Reactions

2. Testing Gases With Litmus

6. Answer the following questions in relation to your experiments

1. Classify the following as either acidic or basic.

1. vinegar_____

2. baking soda_____

2. What was the temperature of the vinegar?

(a) before the reaction_____

(b) after the reaction _____

(c) conclusions_____

3. Classify the following as acidic or basic.

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1. Household ammonia_____

2. Vinegar_____

When you mixed the following was there a temperature change?

_____ conclusion_____

7. A. What was the results of testing ammonia gas with dry litmus_____

_____ damp litmus_____

B. What was the results of testing the gas from hydrochloric acid

with dry litmus_____ moist litmus_____

Conclusion_____

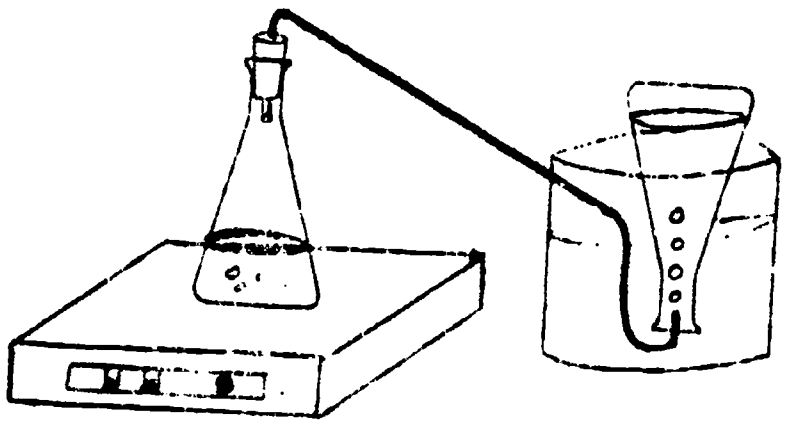
Do the following experiment and answer the questions within experiment.

EXPERIMENT

1. Examine the labels on the cans of different kinds of baking powder. Note that all of them contain baking soda. In addition, each can may contain cream of tartar, or alum, or an acid phosphate. Are cream of tartar and alum acidic or basic?

2. Why don't cream of tartar and alum react with the baking soda in the baking powder? What do you think would happen if water were added to baking powder? try it Record your observations.

3. Gas given off by baking powder forms bubbles in cake dough. The dough hardens when baked so that the cake remains full of small holes. Such a cake is lighter and more tender than a cake baked from solid dough.



4. Set up the apparatus shown and determine how much gas is given off by baking powder.

5. Put a level teaspoonful of baking powder in the flask of cold water and collect the gas produced. Mark the level of the gas in the collection bottle.

Experiment (cont.)

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6. Turn the collection bottle right side up. Measure the amount of water needed to fill it to the top again. How much gas was given off by the baking powder when cold?

7. Now repeat the same procedure but this time heat the water and baking powder. How much gas is given off when the solution is warm?

8. Dissolve 1 level teaspoonful of baking soda in a cup of water. Add cream of tartar slowly, stirring it constantly until the liquid is neutral. How much cream of tartar is needed to neutralize one teaspoonful of baking soda?

[illegible] baking soda and dry cream of tartar in proper proportions [illegible] neutralize each other. Collect and measure the amount of gas [illegible] given off by your homemade baking powder. Compare the results with the same amount of commercial [illegible] baking powder.

[illegible] your [illegible] powder home and bake cake in muffin cups [illegible] baking powder with batter for some of the cups, a [illegible] in others, and you might try yeast since it [illegible] spaces in batter.

[illegible] table salt, NaCl- Perform the following experiment. [illegible] performed as a demonstration by your teacher or a group.

[illegible] the name of the acid and base that we use and the name of the salt that we make.

E X P E R I M E N T

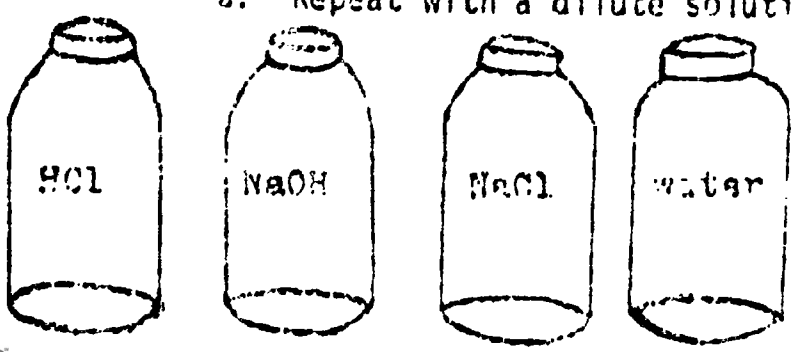
Neutralization

Many important crops such as clover, peas, and beans grow best in soil that has a pH of about 7.0 (neutral). Such crops do not do well in acidic soils. Acidic soils can be neutralized by the addition of basic chemicals. Ground limestone is often used because it produces basic chemicals as it weathers. Thus its effect on the soil can last a long time.

In this investigation we will examine reactions of acids and bases.

1. Place one drop of a dilute solution of hydrochloric acid on a strip of red litmus paper and a second drop of the same solution on a strip of blue litmus paper.

2. Repeat with a dilute solution of sodium hydroxide and then sodium chloride and finally, distilled water.



Make a table and record your results.

SOLUTION	RED LITMUS	BLUE LITMUS

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Experiment (cont.)

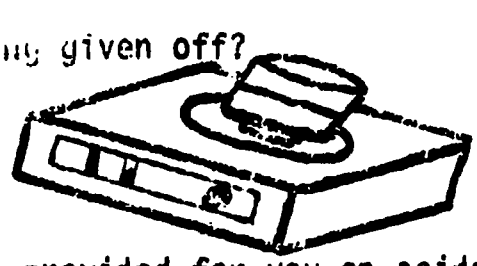
3. Pour 10 ml of dilute sodium hydroxide solution into a small beaker. Place a piece of blue litmus paper in the solution.

4. Stir the solution and add dilute hydrochloric acid drop by drop until the litmus just turns red.

5. Now add sodium hydroxide solution one drop at atime until the litmus turns blue again. Again add acid until one drop of acid will turn litmus red or one drop of base will turn it to blue.

6. Next, heat the misture gently until the water is nearly gone, and then let the rest of the water evaporate. With a magnifying glass, examine the solid residue. Do you recognize the cubic crystals of sodium chloride? Taste it. What is it?

7. How do you account for the heat being given off?



8. Complete the worksheet which will be provided for you on acids, bases and salts.

9. Classify foods or substances and classify them as acid or neutral.

1. aspirin_____
2. soap_____
3. soda pop_____
4. lemon_____
5. buttermilk_____
6. sugar solution_____
7. orange juice _____
8. milk of magnesia_____
9. weak lye solution_____
10. household ammonia_____

12. For review answer the review questions and thought questions on page 48 of the EPS textbook. Pass your answers in to your teacher for evaluation.

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Additional Resources for Section II

Modern Physical Science

Topic: Acids, Bases and Salts pp. 45-53

Pathways In Science

Book 2 Chemistry of Mixtures

Topic: Compounds Called Acids pp. 96-101 and pp. 118-122

Topic: When An Acid Meets Base pp. 107-110, pp. 118-122

[illegible] Teaching Tape

[illegible] and Compounds"

[illegible] Agency

[illegible] and Salts

Worksheet

Acids, Bases, Salts

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Self Evaluation Section II

1. Name two crystals which contains water of hydration.

   1. 2.

2. How can you hydrate a crystal?_____

   dehydrate a crystal?_____

3. How can you test for the presence of oxygen?_____

4. When blue litmus paper turns red, what does this tell you about the solution?_____

5. What is a 'neutral' solution?_____

6. What is the name of the gas in soda pop?_____

7. Why is baking soda solution used as a first aid treatment for burns caused by an acid?_____

8. How can acidic soils be neutralized?

9. What is meant by the symbol pH?_____

   Using the pH scale

10. Classify the following as being either acidic, basic or neutral.

    pH (1) _____ pH 7_____ pH 14_____

11. How can you make an indicator in the laboratory?_____

    _____

12. What gas is given off by heating baking soda?_____

13. Does the temperature (rise, fall or remain the same) when an acid and base reaction occurs?_____

14. Name two acidic substances.

    1. 2.

    Name two basic substances.

    1. 2.

15. Briefly explain how you can make table salt.

16. What is the scientific name for table salt? _____

17. Classify the following as acidic, basic or neutral.

    1. salty water _____ 2. lemon _____ 3. ammonia_____

18. How can you drive the gas out of baking soda?_____

    _____

19. When making table salt how could you tell when the solution was neutral?

    Acidic?_____

    Basic?_____

20. How was the salt obtained from the liquid solution?

Advanced Studies

1. Determine the weight of the water of crystallization that is driven off by heating a sample of alum. Calculate the percentage of the original weight made of water.

2. Make a cake batter <u>without</u> baking soda. Divide the batter into several equal parts. Add different amounts of baking powder to each part and bake samples in muffin cups. Keep a record of the results.

3. Extract the juice from different fruits. Mix with acidic and basic solutions to see which juice changes in color. Prepare a chart showing the color changes.

4. Find out whether freezing or boiling fruit juice affects the way they react to acidic and basic solutions.

5. Perform a demonstration on the "water to wine trick" pp. 45-46 EPS.

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LEARNING ACTIVITY PACKAGE

OXYGEN AND OXIDATION

Ninety Six High School
Ninety Six, S.C.

PHYSICAL SCIENCE 92

REVIEWED BY

LAP NUMBER 4

WRITTEN BY G. J. Williams

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RATIONALE

Come aboard for another exciting adventure. We have just completed a LAP on the Nature of Water a very essential compound. Now we are going to study about one of the elements which makes up water, oxygen. In this LAP also, we are going to consider some other interesting gases.

From the viewpoint of mankind, oxygen is one of the most important substances in the world. All living things use oxygen in one way or another, and most of them cannot live without it. Oxygen unites chemically with many other substances, which is often an advantage to man, but sometimes is not.

Now, on with the study of some important gases. In our next LAP we will consider the study of carbon as an element.

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Section I

BEHAVIORAL OBJECTIVE 1 A

After performing the following activities, you will be able to state some properties, uses, means of preparation, and tests for the following gases:

1. oxygen
2. carbon dioxide
3. carbon monoxide
4. sulfur dioxide

ACTIVITIES

I. Read and make a written summary about the following topics and read the following pates in your textbook. EPS and World Book Encyclopedia.
   1. Oxygen, pp. 50-57
   2. Carbon dioxide p. 56 Also consult the World Book, Book 3 (1972 edition) pp. 167-168 Topic: Carbon dioxide
   3. Carbon monoxide- consult the World Book Encyclopedia Book 3 (1972 edition) p. 168 Topic: Carbon monoxide and page 62 of EPS.
   4. Sulfur dioxide read page 61 of EPS State a use of SO_2

II. Observe the demonstration on the means of preparing the following gases.
   1. oxygen
   2. carbon dioxide
   3. sulfur dioxide

III. Record the following information about each of the above gases on a chart as they are prepared.
   1. Name of the gas prepared
   2. Name of the chemicals used to prepare the gas

3. The color of the gas.

4. The odor of the gas.

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5. The method used to prepare the gases.

6. Four uses for each of the gases stated

7. How to test for the presence of the gas.

IV. Give the reason you feel that we did not prepare carbon monoxide gas in class. (Reread the properties of carbon monoxide in the World Book Encyclopedia- p. 108 vol. 3 Topic: Carbon Monoxide)

5. Read pp. 52-53 State the role the following play in the rusting process: 1. Water 2. Oxygen .

6.(a) perform the experiment I at the top of page 53 in the EPS textbook. First perform the experiment as described at the top of page 53- EPS.

1. What gas was produced? _____

(b) Next set up the equipment II as shown at the top of page 53, but instead of using baking soda and vinegar use manganese dioxide and hydrogen peroxide.

2. What gas was produced?_____

(c) Make a comparison between the rusting which occurs with

Experiment I_____

AND

Experiment II_____

Conclusion_____

_____

7. Read page 677 in the World Book- Vol. 14 Topic: Oxidation.

(a) State the role oxygen plays in the rusting process.

_____

(b) What is the name of the red compound that when iron unites with oxygen. _____ (World Book Vol. 14 page 677)

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(c) State whether moisture or water is necessary for rusting to occur._____

(Refer to page 52 in EPS)

(d) List three ways rusting can be prevented.

1. 2. 3.

(Refer to page 52 of EPS in textbook)

(e) What is meant by the term oxidation? (refer to page 56 of EPS)

(f) Name two products of oxidation (refer to p. 56 of EPS)

(g) Use a dictionary or MFS book and state the difference between an example for:

1. slow oxidation

DEFINITION_____

Example(s)_____

2. Rapid oxidation

DEFINITION_____

Example(s)_____

(h) Classify the following as being the result of rapid or slow oxidation.

1. rusting_____

2. burning flame _____

BEHAVIORAL OBJECTIVE I B

After completing the following activities you will be able to state the reason oxygen is important in our daily life

ACTIVITIES

I. Read page 679 of the World Book Encyclopedia Volume Topic: How oxygen supports life (1974 Edition) - Answer the following questions:

1. Where does man and land animals get oxygen?_____

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Trace the path of oxygen from the time it enters man's lungs until energy is produced in the cells.

1._____ 2._____ 3._____ 4._____

Where does oxygen enter a fish's blood stream?_____

Briefly summarize how plants use oxygen.

II. Refer to the World Book Encyclopedia (1972 edition) pp. 679-680

Vol 14 Topics: 1. Other uses for oxygen p. 679

2. Making oxygen pp. 679-680 3. Historyp. 680

4. Chemical properties

(for the following concepts)

1. Find out how Joseph Priestley discovered oxygen (history)

2. Find out how oxygen is produced for welding and in hospitals.

3. List four chemical properties for the element oxygen.

III. Observe and summarize the following filmstrips

1. The Air Around us

2. Oxidation

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Self Evaluation

1. Write the names of the four gases we discussed or prepared in Section I.

2. Select any two of the gases and write down five things you learned about the gas.

   gas (name)_____

   1.

   2.

   3.

   4.

   5.

   gas (name)_____

   1.

   2.

   3.

   4.

   5.

3. Explain why oxygen is such an important gas.

4. What is some differences between the following gases.

1. carbon dioxide	carbon monoxide
1.	1.
2.	2.

5. State a use for the gas sulfur dioxide. _____

6. How can sulfur dioxide be prepared? _____

7. What two things are necessary for rusting to occur?

   1. 2.

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Self Evaluation (cont.)

8. Will the gas carbon dioxide cause rusting?_____

9. What is the meaning for the term oxidation?_____

10. What is the difference between the following terms.

    1. slow oxidation

    2. rapid oxidation

11. State where man and land animals get oxygen?_____

12. How did Joseph Priestley discover oxygen?

13. List four uses for oxygen other than being a necessity for man and animals.

    1. 2.

    3. 4.

14. List two properties of oxygen.

    1. 2.

15. List an example for each of the following conditions.

    1. slow oxidation

    2. rapid oxidation

Advance Study

Section I

1. Make a poster displaying the name(s) of either and/or one of the following gases.

   1. Carbon dioxide 2. oxygen 3. sulfur dioxide 4. carbon monoxide (include on your poster pictures, diagrams, statements, etc. to prove the gas's 1. importance 2. usefulness 3. occurance

2. Find out whether carbon dioxide is heavier than air by performing experiment I on page 76 of EPS.

3. Set up a series of experiments to show which factors encourage steel to rust and how to prevent rusting.

4. Perform experiment II on page 76 of EPS and see if carbon dioxide can be produced (The center diagram)

5. Produce carbon dioxide in a large bottle and pour thegas down a trough containing small candles as shown at the right and in the central diagram and page 77 of the EPS book.

6. Freshly peeled potatoes and apples often turn brown in the air Set up an experiment to find out whether this change is caused by oxidation. (Bring your potatoes and cellophane paper from home)

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BEHAVIORAL OBJECTIVE I A

After completing the following activities you will be able to state or list the following concepts about fire and flames.

1. What is fire?
2. Kinds of fire
3. How fire is produced
4. The kindling temperatures of some common materials
5. What fire produces
6. How to determine the amount of useful heat

ACTIVITIES

Activity I A (Research on fire and flames)

1. Read pages 115-118 in the World Book Encyclopedia Vol. 7

   Answer the following questions:

   1. What is fire?
   2. What happens as a substance burns?
   3. What is another term which might be used which means the same thing as burning?

4. Differentiate between the following terms and give an example of each:

   1. slow oxidation 2. combustion 3. oxidation 4. explosion

5. List the names of three different kinds of fires.

   1. 2. 3.

6. What three conditions are necessary before a fire will start?

   1. 2. 3.

7. What is meant by kindling temperature?

8. State the kindling temperature for the following materials.

   1. paper
   2. cotton
   3. cellophone
   4. wood
   5. wood pitch
   6. natural gas

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9. Explain why ashes remains after the burning of wood or coal.

10. List three things that fire produces:

    1. 2. 3

11. What conditions cause smoke and soot?

12. State two reasons light might be produced from a fire

    1. 2.

Other references which may be used for Activity I are

1. Tape and Filmstrip Fire and Fuels
2. Your textbook EPS p. 72-73
3. Fuels and Heat

Activity II Perform the experiment on oxygen and rate of burning on top of page 67 of your textbook EPS.

State your conclusion: How does oxygen affect the rate of burning.

Activity III A

Study the diagram at the bottom of p. 73 in your textbook summarize what it is used to represent.

Make a similar drawing to represent conditions which would probably occur if.

(a) Perfectly dry wood is burned

(b) If very damp wood is burned.

State your conclusion Which produces more useful heat

(a) nearly dry wood

(b) perfectly dry wood

(c) very damp wood

Explain your answer

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Activity IV IA

9. State the names of two units used to measure heat.

   1. 2.

   (b) Which of the units for measuring heat is used in the

   English speaking coutries?_____

   The metric System?_____

   (.) What does the abbreviation BTU mean?

Activity V IA

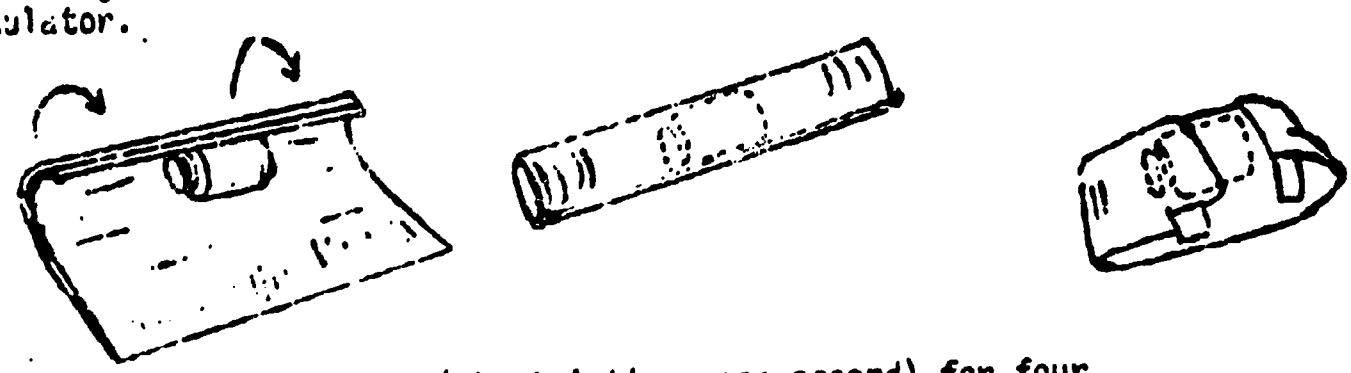
Energy Transfer: Perform the following experiment and answer the questions stated within.

ENERGY TRANSFER EXPERIMENT I

There are many ways in which potential energy can be converted to kinetic energy. The most familiar source of energy is the food you eat. In this investigation you will provide the source of potential energy. Your muscles will convert some of the potential chemical energy in the food you have eaten into kinetic energy - energy of motion. You will observe the effect of transferring this energy to a sample of water.

1. Pour 20 ml of water into each of 2 glass jars. Record the water temperatures.

2. Tighten the lids on the jars. Wrap both jars in newspaper, as shown. When you are finished the jars will be wrapped in at least eight thicknesses of paper. The paper will act as a heat insulator.



3. Shake one jar vigorously (about 4 times per second) for four minutes. Members of the team may take turns doing this so that the shaking continues at a rapid pace. In shaking the jar, move it less than 2 inches, back and forth. Do not shake the second jar.

4. Unwrap the jars. Remove the lids and again record the temperature of the water in each.

A. Calculate the temperature change (if any) in each jar, and record in your data book. The unit for measuring heat energy

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is the calorie. One calorie is the amount of heat energy required to raise the temperature of 1 gram of water $1^{0}C$. How many calories were gained by the water in each jar?

B. Using the kinetic theory of heat, explain any temperature changes that you observed.

C. If 1 gram of water cooled from its boiling temperature (at sea level) to freezing, how many calories were lost by the water?

Activity VI 1A Heat Storage

Perform the following experiment and answer the question within. State the kinetic theory of heat.

HEAT STORAGE EXPERIMENT II

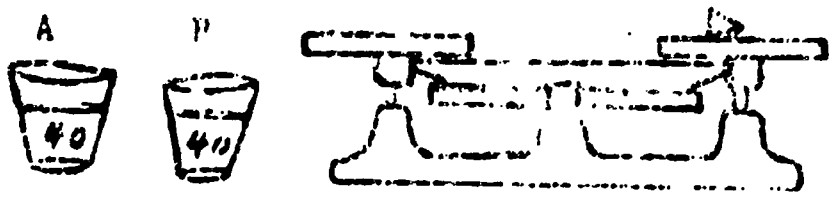
Water can store heat energy. Other liquids, as well as metals, can also store heat energy. But different materials have different capacities for heat storage. In this investigation you will compare the heat storage capacity of equal weights of water and a metal.

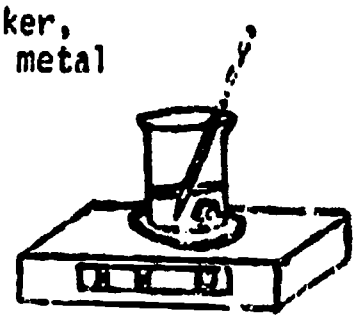
Before doing this investigation, predict which has the greater heat storage capacity - a metal or water.

1. Label one styrofoam cups A and B. Pour 40 ml of tap water into each cup.

2. Using the balance, find the weight of the metal to the nearest gram. Tie a 10 inch length of thread to the metal. Weigh out an amount of tap water equal to the weight of the metal.

3. Place the metal object and water from procedure 2 in a beaker, and heat to about $80^{0}C$. (Allow the thread attached to the metal to hand over the edge of the beaker.)





4. When the temperature of the water has reached $80^{0}C$, transfer the metal to Cup A and pour the hot water into Cup B. Stir the contents of both cups for one minute. Then record the water temperature in each cup.

A. Which contains more heat energy - a metal at $80^{0}C$, or an equal weight of water at $80^{0}C$?

B. Using the kinetic theory of heat, what we have learned about the structure and behavior of matter, explain your answer to question A.

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Perform the following experiment and answer the questions that are stated within.

Classify the following type of heat transfer as:

1. Connection 2. Radiation 3. Conduction

State the meaning for the type heat transfer you name.

HEAT TRANSFER E X P E R I M E N T III

1. Get a metal rod 1/8 to 1/4 inch in diameter and a foot or more long. Clamp it at one end so that it is in a horizontal position.

2. Put a candle under the far end and heat the metal by means of a flame.

3. How can you observe what happens?
   You could watch the thermometers on the rod.
   Touching it with your hand is not a good idea.
   You could drop chips of paraffin or candle wax.

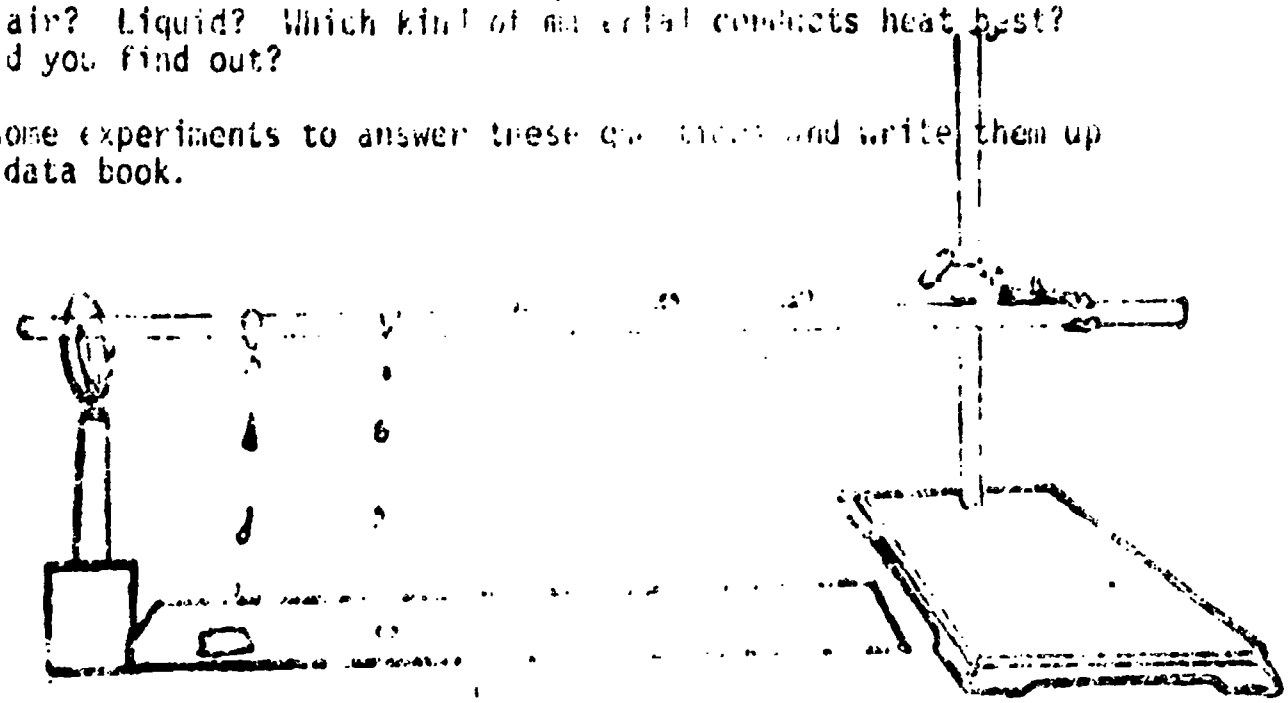
The wax is placed at regular intervals along the metal rod. As soon as the temperature of the rod under a given chip reaches the melting point of wax, the chip melts. By observing the wax chips melting, you can get an idea of the conduction of heat along the metal rod.

4. See how long it takes for each chip of wax to melt. How rapidly does heat travel in this metal rod? Do you think that heat travels at the same rate of speed in all kinds of metal? How would you test this?

5. How hot is the metal rod? How could you find out?

You have seen that heat travels through metal. Does it also travel through air? Liquid? Which kind of material conducts heat best? How could you find out?

Design some experiments to answer these questions and write them up in your data book.



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Activity I A (cont.)

(a) Observe and summarize the filmstrip "How Heat Travels" pass in your summaries for evaluation.

(b) Study the chart in the science department.

1. Fuels
2. Heat

Summarize the information which is given and the chart about the above topics.

Activity VIII I A Heat Capacity of Oil

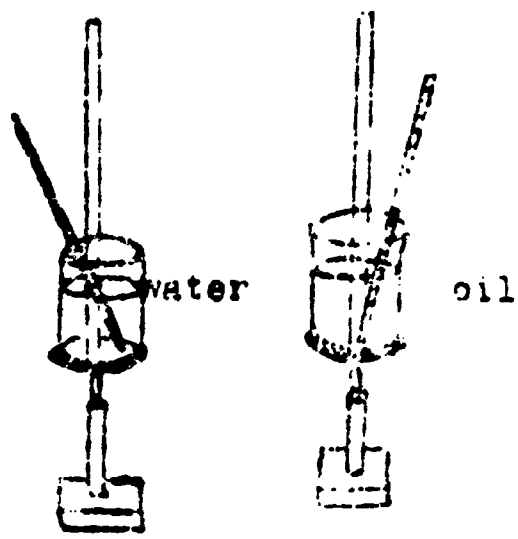
Perform the following experiment and answer the questions stated within.

EXPERIMENT IV

1. Heat 20 grams of water in a small beaker over a candle flame. Take the temperature every 30 seconds until the temperature [illegible]

2. Repeat the measurements using 20 grams of cooking oil. Keep other variables as constant as possible; for example, the size of the candle, the size of the container, and the distance between the flame and container.

3. Make a graph of the results of the experiment, plotting the time and temperature as shown on the back of this card.



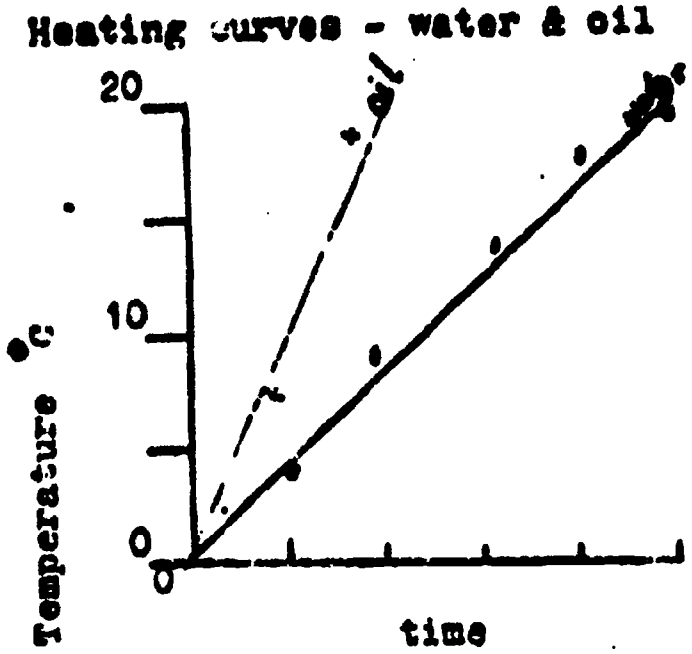
1. [illegible] calorie of heat needed to raise the temperature of one gram of oil 1°C? Explain.

4. Compare the times needed to heat water and oil the same number of degrees using the following ratio:

$$\frac{\text{time needed to heat oil } 20^{\circ}\text{C}}{\text{time needed to heat water } 20^{\circ}\text{C}}$$

5. What does this ratio tell you about the heat capacities of the two substances

C. The heat capacity of water is 1 calorie per gram for each degree. What is the heat capacity of oil?



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D. Determine the heat capacity of other liquids using the same method described here.

E. Is the heat capacity of a desert the same as that of land near a lake? Explain.

Activity IX IA Steam Turbines

Perform the following experiment and answer the questions stated with..

Look for 1 act five other uses for heat.

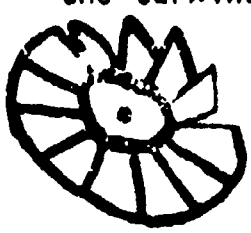
STEAM TURBINES EXPERIMENT V

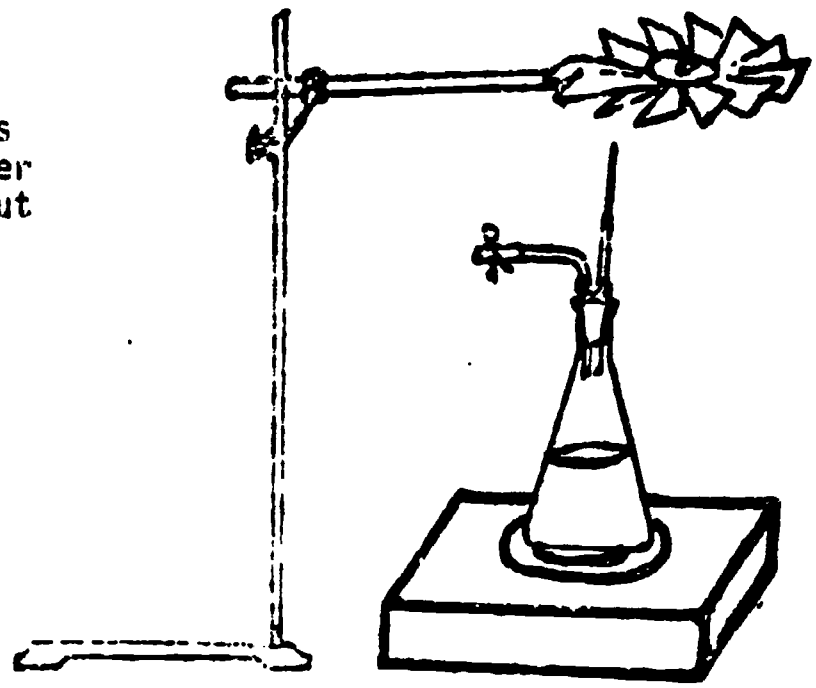
1. Cut the bottom out of an aluminum pie plate. Mark off 20 - 30 evenly spaced points around the circumference of the disk. Use tin snips to make cuts 2 cm long along the radii at these points. Use pliers or tweezers to twist each vane in the same direction. This is the rotating part of the turbine.

2. Draw a piece of glass tubing into a sort of nozzle and bend another piece of tubing. Put the 2 pieces of glass tubing in a rubber stopper and fit it on a flask that is about half full of water.

3. Nail the disk to a wooden rod and clamp this to a ring stand.

4. Heat the water in the flask and the turbine is ready for action.





A. What can a steam turbine be used for?

B. Gasoline engines make use of the pressures produced when gases are heated. Gasoline is ignited inside the engines, heating air and other gases to a very high temperature. The forces thus produced are used to drive lawn mowers, boats, automobiles, and airplanes. Why are gasoline engines called internal-combustion engines?

5. Study one of the small engines used for model airplanes. Locate the fuel tank. Trace the path of the fuel from the tank into the engine. Find the place where the fuel mixes with air before

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entering the engine.

C. Can the flow of gasoline be regulated? If so, how?

D. List other ways in which you use your knowledge of heat --
Ex. refrigeration - how does it work?
airconditioning - how does it work?
thermos bottles - how do they work?
solar heating - how does it work?
etc.

Self Evaluation

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1. Define the following terms.

   1. fire

   2. kindling temperature

   3. combustion

   4. slow oxidation

   5. rapid oxidation

2. Name the three basic ingredients necessary before a fire will start.

   1. 2. 3.

3. How does oxygen affect the rate of burning?

4. From which would you most likely get the most useful heat.

   1. damp wood _____

   2. perfectly dry wood _____

   3. nearly dry wood_____

5. Name and define two units used to measure heat.

   1.

   2.

6. Name three methods of heat transfer and state which one was observed in experiment III.

7. When experiment I Energy transfer was performed was there any change in temperature? _____ Explain.

8. Does water and metal have the same heat starting capacities?

   _____ Explain.

9. Does water and oil have the same heat capacity? Explain.

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Self Evaluation (cont.)

10. How long does it take to heat water to 20°C? _____

    Oil? _____ Conclusion?

11. What is a steam turbine?

12. List five uses for heat.

    1. 2.

    3. 4.

    5.

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Advance Study

1. Prepare a report on the methods used for detecting and fighting forest fires.

2. Make a model soda acid fire extinguisher as shown at the left, in the middle of page 78 EPS. Demonstrate how it operates to the class.

3. Make a chart dealing with fire safety.

4. Choose one of the elements from page 59 EPS. Find out all you can about it and report to the class.

5. Demonstrate how to make a foam type extinguisher. You will find the materials needed and the procedure to use on the bottom of page 79 in the EPS book.

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BEHAVIORAL OBJECTIVE

After completing the following activities you will be able to observe and state some of the effects of heat.

ACTIVITIES - Heat and Temperature

1. Perform the following experiment and answer the questions stated.

HEAT AND TEMPERATURE E X P E R I M E N T

1 Label the styrofoam cups A, B, and C. Put about 40 grams of ice and 40 grams of cold water together in cup C.

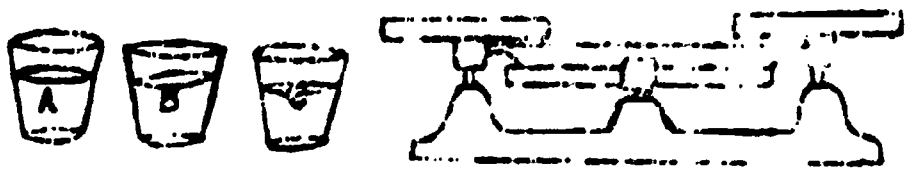
2 Weigh cups A and B. Record the weights in your data book.

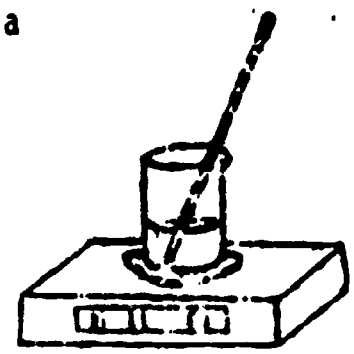
3 Pour 200 ml. of tap water into a beaker, and heat to boiling. While the water is heating, complete procedures 4, 5, and 6. When the water starts to boil, turn off the heat and set the beaker of hot water aside for use in procedures 7 and 8.

4. Pour 40 grams of water from the ice - and-water mixture into cup A.

5. Place cup B on the balance, and add about 20 grams of ice. The amount added should be weighed as accurately as possible. Record the weight of the ice in your data book. Pour water from the ice-and-water mixture into cup B until there is a total of 40 grams of ice and water in cup B.

6. Record the temperature of the contents of each cup.





7. Wrap a folded paper towel around the beaker of hot water so you can pick it up without burning your hand. Pour 40 ml of hot water into a graduated cylinder, and place a thermometer in the water. When the temperature has fallen to 50°C, pour the water into cup A. Stir the mixture carefully for several seconds with a spoon or mixing stick. Record the temperature of the mixture in your data book.

8. Pour another 40 ml of hot water into the graduated cylinder. When it has cooled to 50°C, pour it into cup B. Then stir the mixture carefully. As soon as all of the ice has melted, measure the temperature of the mixture and record it in your data book.

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A. Compare the final temperatures in cups A and B. Why are they different?

B. Remember that three phases of matter are solids, liquids, and gases. Predict what would happen to the temperature of boiling water if you added heat energy to it.

C. In procedure 7, how many calories of heat were lost by the hot water as it cooled from 80° to the final temperature of the mixture? How many calories were gained by the water in cup A?

D. In procedure 8, how many calories were lost by the hot water after it was poured into cup B? How many calories were gained by the ice-and-water mixture in Cup B?

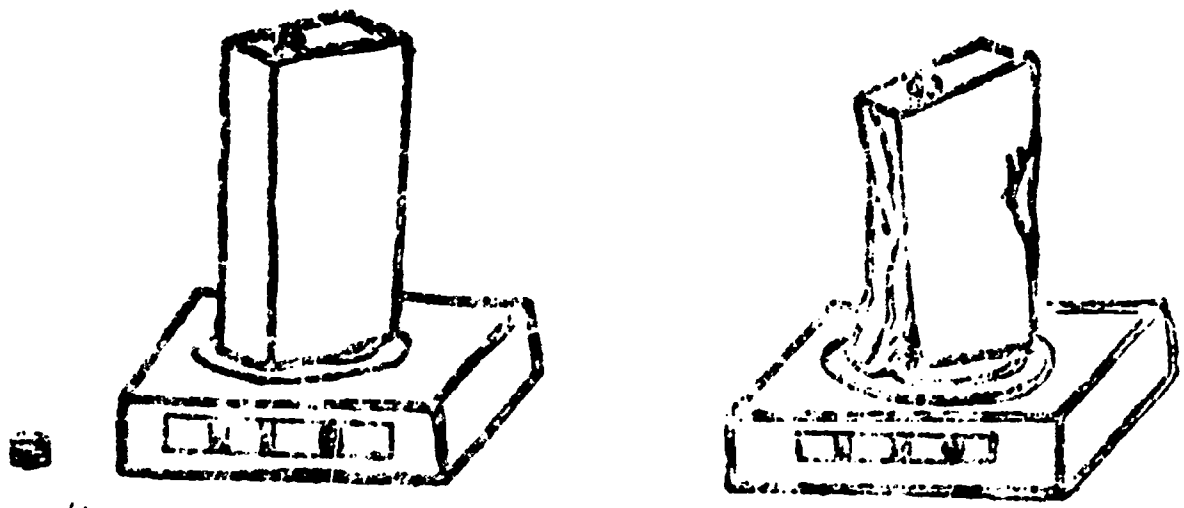
Activity 2 Effects of Condensation

Perform the following experiment. (You are responsible for bringing your own can for this experiment.)

Safety precautions stated within the experiment.

CONDENSATION EXPERIMENT

1. Pour a quarter cupful of water into a clean gallon can like that shown below.
2. Heat the open can until a cloud appears above the opening.
3. Remove the can from the heat, screw the top on tightly, and cool the can. Watch as the can cools.



(Reference page 130 EPS)

Boiling water inside the can produces water vapor. This water vapor forces out much of the air inside the can. When the can is sealed and cooled, the water vapor condenses into drops of water.

The condensation caused what to occur inside the can to take its change in shape?

Was air pressure outside the can greater than or less than inside the can?

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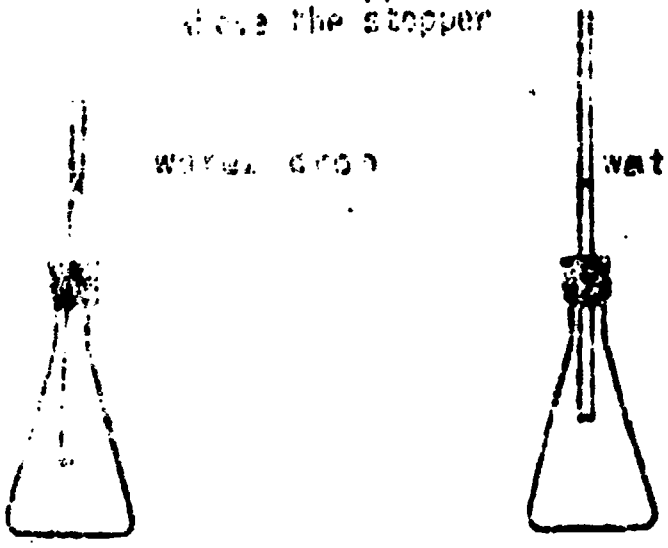
Activity 3 **Heat and Volume**

Perform the following experiment and answer the questions stated within.

HEAT AND VOLUME EXPERIMENT

1. Insert the glass tubing into the hole of the stopper so the tubing will extend about halfway into the flask when the stopper is in position.

2. Put a drop of water in the glass tubing and let it move down the tubing until it is near the top of the stopper. Stop the drop by placing a finger over the top end of the tubing. Keep your finger on the tubing, and seal the flask with the stopper. Adjust the position of the drop by pushing down or pulling up on the stopper, so that the bottom of the drop is slightly above the stopper



3. Measure and record the distance between the top of the stopper and the drop.

4. Wrap your hands around the flask for several seconds. Measure and record any change in the position of the water drop.

5. Blow the water droplet out of the glass tube. Remove the stopper and fill the flask to the brim with water. Insert the stopper into the flask, allowing excess water to spill out. Push the stopper down until the level of the water in the glass tube is about 20 cm above the top of the stopper. The stopper should fit firmly in place.

6. Measure and record the height of the water above the stopper.

7. Wrap your hands around the flask and hold for one minute. Then quickly measure the height of the water column. Record any change in your data book.

8. Using a hot plate, gently heat the flask of water for several seconds. Again measure and record any change in the height of the water column

A. In procedure 4, what was responsible for the movement of the water drop?

B. Compare the movement of the water drop in procedure 4 with the movement of the water column in procedures 7 and 8.

C. For what other purpose might you use the tube and flask apparatus?

Reference: Modern Physical Science p. 451

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Activity 4

Perform the following experiment and answer the questions stated within.

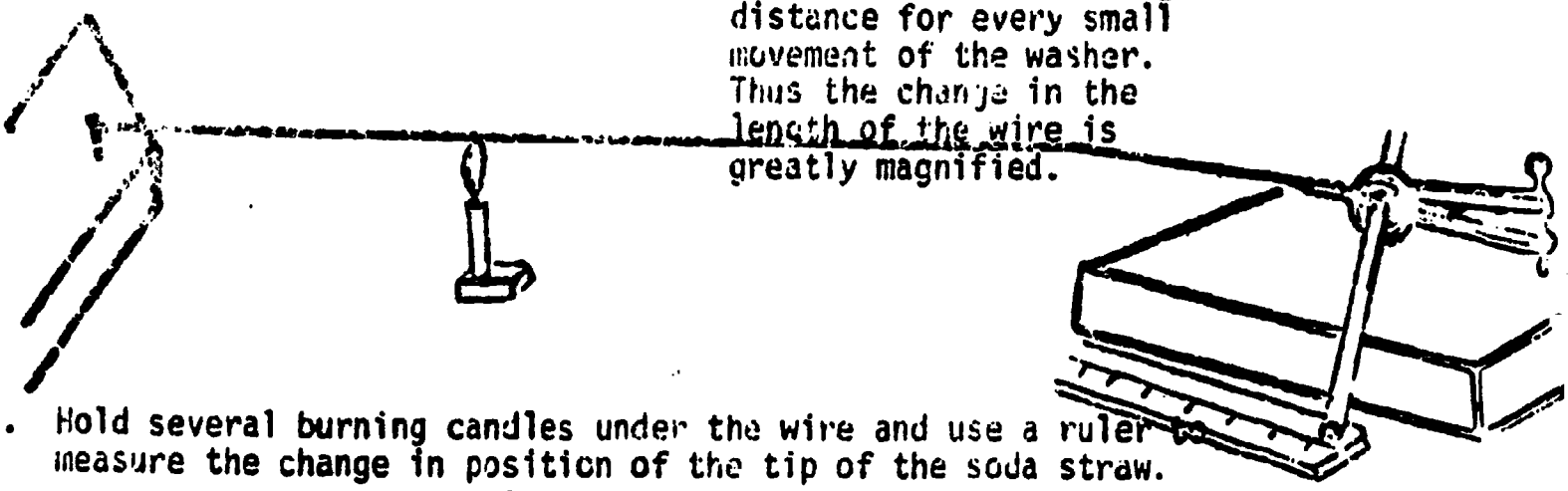
EXPANSION OF SOLIDS — E X P E R I M E N T

1. With the apparatus shown you can compare the expansion of different metal wires.

2. Two wooden blocks are clamped to solid tables about 10 feet apart. The wire to be tested is stretched between nails in the blocks.

3. A double thickness of strong rubber band is stretched between a washer at the end of the wire and a nail in one of the blocks. The rubber band should be stretched almost to its greatest length.

4. The soda straw which pivots at a point close to the washer, will move a large distance for every small movement of the washer. Thus the change in the length of the wire is greatly magnified.



5. Hold several burning candles under the wire and use a ruler to measure the change in position of the tip of the soda straw.

6. Remove the candles and observe what happens to the end of the soda straw.

7. Test other kinds of metal wires in the same way. All the wires must have the same length for accurate comparisons.

8. What can you conclude from this investigation? How could you apply this information in your daily life?

(Reference Modern Physical Science, pp. 253-255.

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Activity 5 Color and Heat

Perform the following experiment and answer the questions stated within.

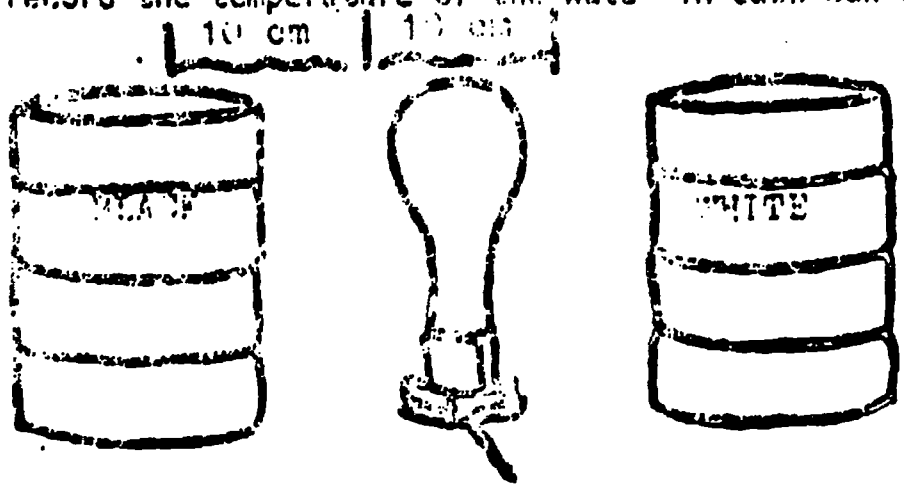
COLOR AND HEAT EXPERIMENT

1. Pour 100 ml of water into each can.

2. Place a thermometer in each can and record the temperatures.

3. Place the cans 10 cm from the center of the light bulb, on opposite sides of the bulb.

4. Divide your team into 2 groups. Each group is responsible for reading and recording temperatures in one of the cans. Readings should be made at the same times by the 2 groups. Turn on the light and record the temperature of the water in each can every 3 minutes.



Continue the readings until there is no change in temperatures for three consecutive readings, or until thirty minutes have elapsed.

A. How do the final temperatures in the 2 cans compare?

B. What does the rate of temperature change in each can indicate about the rate at which heat flowed into the water?

C. Did heat leave the water? How could you tell?

D. From the position of each can in relation to the heat source, what can you say about the rate at which heat was reaching the cans?

E. Can you use the kinetic theory of heat to explain the results of this experiment?

F. Explain why many people who live in hot, sunny parts of the country prefer white or other light-colored clothing instead of black clothing?

G. What color roofing should you put on a house if you live in a cold climate and want to conserve heat?

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Self Evaluation

1. Name the three phases of matter .

   1.

   2.

   3.

2. Classify the following phases of water as solid, liquid or gas.

   _____ 1. cup of drinking water

   _____ 2. ice

   _____ 3. steam

3. How can you demonstrate how calories of heat may be gained or lost in water. Explain.

   gained?_____

   lost? _____

4. Explain what caused the can to crush in the "Effects of Condensation" experiment.

5. Was the pressure outside the can equal to the pressure inside?

6. Explain how heat effects the volume of: 1. solids

   2. liquids 3. gases

7. How does heat affect the length of wire? (Will the wires expand or contract?)

8. Will different kinds of wire expand a different or the same amount under the same amount of heat?

9. How can the expanding of wire and metals be helpful in daily life?

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10. Why do they leave space between the rails on a railroad track?

11. Why do many people who live in hot sunny parts of the country prefer white clothing and other light colored clothing than black?

12. What color roofing should you put on your house if you live in a cold climate and want to conserve heat?

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Advance Study

1. Make a display which shows several different effects of heat. (You may use pictures from magazines, newspapers, pamphlets or real objects.)

2. Make a report on heat and its effects and in your report include these terms.

1. temperature	7. steam turbine
2. evaporation	8. expansion
3. condensation	9. contraction
4. conduction	10. kindling temperature
5. convection	11. calorie
6. radiation	12. BTU

3. Make a chart which displays the advantages and the disadvantages of the expansion of metals.

4. Make a chart which displays the kindling temperature for some common materials.

5. Make a poster which displays the rate at which different materials expand per degree centigrade. (Reference p. 255 MPS)(Linear Expansion)

6. Make a poster which displays the amount of heat needed to raise the temperature of some common substances per degree centigrade and fahrenheit. (Specific Heats) reference p. 258 Modern Physical Science.

7. Find out what is meant by.

   1. Heat of fusion 2. Heat of vaporization

   Make a chart which explains the two above concepts.

8. Make a report which includes the names of some good conductors and some poor conductors of heat.

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LEARNING ACTIVITY PACKAGE

ATMOSPHERIC PRESSURE

Ninety Six High School
Ninety Six, S.C.

Physical Science 92

REVIEWED BY

LAP NUMBER 5

WRITTEN BY G. J. Williams

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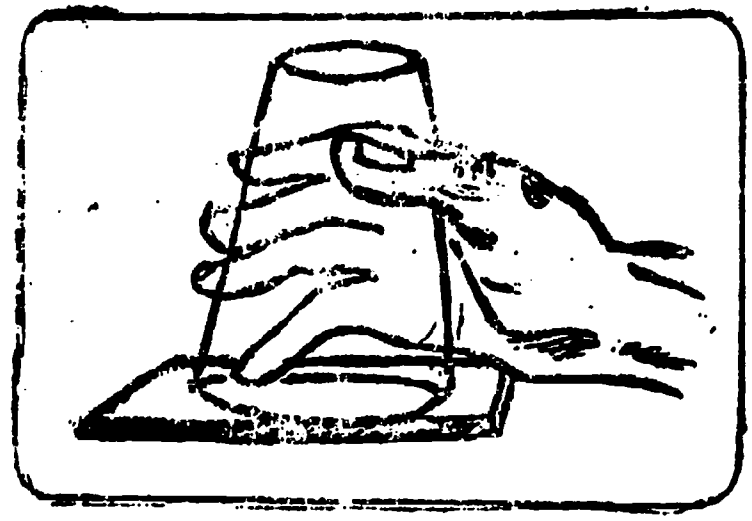

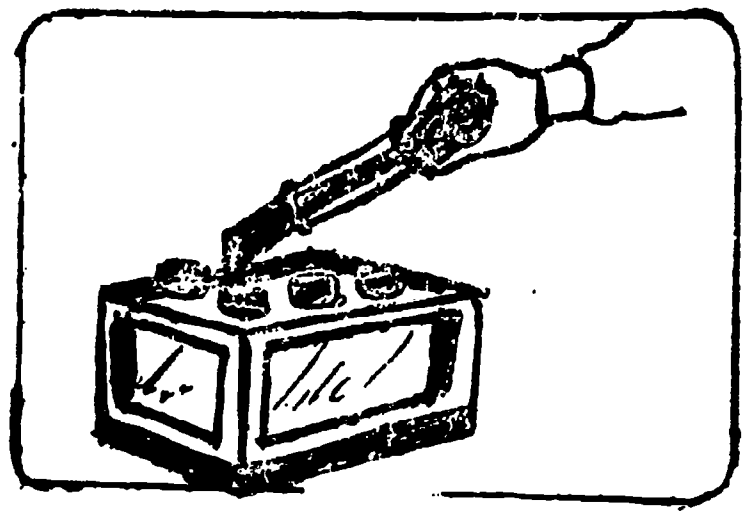

ATOMOSPHERIC PRESSURE

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RATIONALE

We live at the bottom of an air mass many miles thick. This air is pulled downward by gravity and presses against all objects within it.

We rarely notice the great weight of the atmosphere pressures within our bodies are nicely balanced against those from outside. Only when we climb or drop suddenly, as in elevators do we feel pressure changes against our eardrums.

However, the weight of the atmosphere influences our lives in countless ways, producing winds and storms, helping us breathe and drink, and operating hundreds of devices ranging from medicine droppers to automobile engines. We rarely escape from the effects of the huge mass of air above us.

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SECTION I

Atmospheric Pressure:

It is difficult to study atmospheric pressure directly because air cannot be seen and is not often felt. Indirect approaches must be used. Studying the effects of atmospheric pressure upon other things.

In this section you will learn some of the effects of atmospheric pressure.

Behavioral Objectives:

1. After reading page 115 in your textbook and studying the diagram at the bottom of the page, you will be able to differentiate between diagram A, B, C in relation to balanced and unbalanced forces.

2. After using the glossary of your textbook and the dictionaries that will be provided by your instructor and defining the terms listed under activities for Section I. You will be able to complete an exercise that requires the proper usage of these terms (completion exercise) on a worksheet, Progress, and on LAP TEST.

3. After observing the demonstration on the effects of upward and downward (page 117 of your textbook), you will be able to explain why a card will stay in place on an inverted glass of water in terms of water pressure and atmospheric pressure. You will explain this on the Progress Test and on the LAP TEST. (Write up procedure during demonstration).

4. After reading page 118 in your textbook, you will be able to explain the role pressure plays in causing liquids to rise in a straw. You will be required to explain this on the Progress and LAP TEST.

5. Observe the demonstration on "How a Soda Straw Works." Write up procedures and conclusion during the demonstration.

6. After reading page 119 in your textbook, you will be required to identify the purpose of demonstration on page 119 of your textbook A, B, C, and D.
   You will be required to match the purpose of the demonstration with the diagram illustrating the demonstration on the Progress Test and on the LAP TEST.

ACTIVITIES I

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___ 1. Read pages 114-120 in your textbook.

___ 2. Differentiate between balanced and unbalanced pressure.

___ 3. Define the following terms:

a. atmospheric pressure

b. suction

c. vacuum

d. siphon

e. pressure

f. [illegible]

g. air pump

h. cylinder

i. compressor

j. vacuum pump

k. condensation

l. air current

m. streamlined

n. molecular theory

___ 4. Observe demonstration on the effects of upward and downward pressure. Record notes - page 115 - EPS.

___ 5. Read page 118 in your textbook. Write down an understandable explanation of how pressure affects liquids rising in a straw.

___ 6. Observe the demonstration on how a soda straw works: (Write up procedures and conclusion.)

___ 7. Read page 119 in your textbook give the purpose for each demonstration.

___ 8. Perfrom the Experiments enclosed 1. A Battle of Air Pressure and 2. An Effect of Air Pressure. Make sure you understand the principles involved in each of these experiments you will be required to identify the principles on the LAP TEST.

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EXPERIMENT I

A Battle of Air Pressure

STUDENT DEMONSTRATION

Did you ever try to blow up a ballon? It's easy, isn't it? Did you every try to blow up a balloon inside a bottle? That's not so easy. Try it.

Hold a balloon so that it is hanging over the end of an empty soda bottle. Be careful that you don't drop the balloon into the bottle. Now stretch the open end of the balloon over the mouth of the bottle.

Blow up the balloon. Blow harder! It's no use! No matter how hard you blow, you must can't get the balloon to expand.

You can't blow the balloon because, as it starts to expand, something unexpected happens, the expanding balloon squeezes the air in the bottle into a smaller space. As the air is squeezed, it "fights back," and you just can't squeeze it anymore. So the balloon can't be blown up any more.

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Experiment II

An Effect of Air Pressure

Student Demonstration

For this experiment, you will need two apples and two pieces of string, each about two feet long. Carefully tie each string around the stem of an apple. Hang the two apples from a towel rack so that they are about an inch apart. If you do not have a towel rack, you can hold the two strings in your two hands so that the apples hang down, about an inch apart.

Now blow very hard <u>between</u> the two apples. They will come together and bump.

That stream of air you blow between the apples the air pressure between them to lessen. The air pressure on the outer sides of the two apples will now be stronger than the air pressure between them. This will push the two apples together and that's just what happens.

You could do the same experiment using two ping-pong balls. You should use adhesive tape or scotch tape to attach the strings to the ping-pong balls.

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SELF-EVALUATION QUIZ I

1. Briefly define the following terms:

   a. pressure

   b. atmospheric pressure

   c. compressor

   d. vacuum

   e. vacuum pump

   f. air pump

2. Explain how you can perform the following activities:

   a. Increase the pressure inside a balloon

   b. Decrease the pressure inside a balloon

3. What is the difference between an

   a. inflated balloon

   b. deflated balloon

4. What happens to a balloon when you decrease the pressure outside the balloon?

5. What happens if you decrease the pressure inside and outside the balloon at the same time?

SELF-EVALUATION I (cont')

6. What happens if you increase the pressure inside and outside the balloon at the same time?

7. Turn to page 115 in your textbook and explain what is happening in the following diagrams:

   a.

   b.

   c.

8. Classify the following diagrams as being examples of (Balanced or Unbalanced pressure).

   a.

   b.

   c.

9. What happens to the level of water when the air pressure is increased inside the bottle? (Diagram B)

10. What happens to the level of water when the air pressure is decreased inside the bottle? (Diagram C)

11. Turn to page 117 in your textbook, explain the purpose of the diagram.

    If we actually performed the experiment would the card most likely fall off as indicated in the top or the bottom diagram? Explain.

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12. Turn to page 118 in your textbook. Observe the diagram at the bottom of the page. If you were drinking out of a straw as indicated with one hole close, explain what would most likely happen. And why?

13. If you were drinking out of a straw as indicated with one hole open, explain what would most likely happen and why.

14. Turn to page 119 in your textbook. Explain what is happening in the following diagrams.

    a.

    b.

    c.

    d.

15. What is the general purpose for each of the above demonstrations.

ADVANCED STUDY

____ 1. Write a report on Section I. (No less than 2 pages and use two or more references) on the topic "Atmcspheric Pressure."

____ 2. Make a poster which will display either of the following topics:

a. Balanced and/or Unbalanced Pressures

b. Upward and Downward (Balanced or Unbalanced Pressure)

c. Pressure and the Soda Straw

____ 3. Prepare an exhibit of common devices that make use of atmospheric pressure.

____ 4. Turn to page 142 in your textbook and observe the diagram to the left at the top of page 142. Set up the "Fountain in a Bottle" apparatus shown. Fill the bottle about $\frac{1}{3}$ full of water and raise it to the position shown. Ink or food coloring in the water makes the action clear.

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Section 2

Using Atmospheric Pressure

Introduction

The pressure of the atmospher plays a bigger part in our lives than most people realize. It makes breathing possible and helps us drink liquids. Atmospheric Pressure is also used in the operation of a large number of important devices ranging from fountain pens to automobiles.

Behavioral Objectives:

1. After reading the introduction to this section and page 120-125, you will be able to list at least 8 devices that operates with the help of atmospheric pressure. Example--medicine dropper.

   You are required to learn at least four of these. You will list four on the LAP and Progress Test.

2. In order that you will learn how atmospheric pressure aids in the operation of some familiar devices, select one of the following topics and write a two page report on how it operates in relation to atmospheric pressure.
   1. medicine dropper p. 120 in textbook
   2. vacuum cleaner p. 202 World Book Encyclopedia and p. 121 of textbook
   3. siphon p. 395 World Book Encyclopedia and pp.122-123 in textbook
   4. Plumber's plunger pp. 124-125 in textbook.

   You will be evaluated upon content, your understanding of, and the presentation of your report.

3. After reading page 120-125 in your textbook; observing the following demonstrations; making a write-up of procedures used and listening to a lecture which will be given by your instructor, you will be able to identify the principles of the following demonstrations.
   1. Pressure changes within a medicine dropper
   2. Experimenting with a siphon
   3. Lifting with atmospheric pressure
   4. Measuring Rate of Flow

   You will be required to identify the basic idea involved on the LAP and/or Progress Test.

4. After you construct a poster displaying four common uses of atmospheric pressure, you will become aware of some everyday common uses of atmospheric pressure. Your poster will be evaluated on neatness, content, ideas displayed, and presentation.

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ACTIVITIES II

___ 1. Read the introduction to Section II and pages 120-127 in the EPS Textbook.

___ 2. List the names of 8 devices that operates with the help of atmospheric pressure. Learn the names of four of these devices.

___ 3. Prepare a report on one of the topics listed under section II Behavioral Objective 2.

___ 4. Observe the demonstrations listed under Section II Objective #3. Write up procedure used and make sure you understand the basic ideas involved.

___ 5. Construct a poster displaying four common applications of atmospheric pressure.

___ 6. Prepare a write-up of how the following devices operate in relation to atmospheric pressure.

a. siphon

b. medicine dropper

c. vacuum cleaner

d. battery tester

e. suction cups

___ 7. Experiments or demonstrations:

a. Medicine dropper - page 120. EPS.

b. Experimenting with a Siphon. page 122. EPS.

c. Measuring Rate of Flow. page 122. EPS.

d. Explaining a Siphon. page 123. EPS.

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Experiment III

Air Pressure at Work — **Student Demonstration**

There are many experiments that you call "tricks" because you are surprised at what happens. Well, then, here is another trick to surprise you!!

Get a funnel. Drop a dime into the funnel, it will settle at the bottom. Hold the funnel near your mouth and blow hard along the inner side of the funnel. The dime will stay right where you dropped it, no matter how hard you blow.

So far, you're no surprised. But her comes the tricky part!! Hold your hand over the bottom opening of the funnel. Then blow down the inner side of it just as you did before. This time the dime will rise up as you blow, and it may even jump out of the funnel.

How did it happen?? It's a very simple matter of air pressure. When you covered the bottom of the funnel and blew into it, the air stayed in the stem of the funnel. So there was actually more air in the stem of the funnel than there would be normally. This extra air increased the air pressure and extra air pressure pushed the dime upward!

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Section 3

Changing Air Pressure

When additional air is squeezed into a space, the pressure increases. When air is removed from a space, the pressure decreases. Air pressure can also be changed by changing the size of the container. If the container is made smaller without air escaping, the pressure increases. If the container is made larger without air entering, the pressure decreases.

Behavioral Objectives:

1. After reading page 127-128 of your textbook, you will be able to identify the parts and how the parts operate in a bicycle pump. You will be able to define the term "compressor" and tell what it is generally used for.

   You will be able to define the term "vacuum pump" and list some of its common uses.

   You will be required to perform each of these activities on the Progress and the LAP Test.

2. After reading pages 128-129 and observing the following demonstrations: (a) Heat and Cooling Air
   (b) Egg-in-a-Bottle Trick
   * (c) Low Pressure by Condensation
   You will be able to explain in writing the effects of heating and cooling on the pressure of air. You will be required to write this explanation on the Progress and/or LAP TEST.

3. After reading pages 132-135 in your textbook and studying each illustration, you will be able to briefly explain the following topics:

   (1) The Effects of slowing down air.

   (2) The Operation of an Electric fan in relation to air pressure.

   (3) The Effects of Speeding up Air.

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(4) Pressure on Airplane wings (perform experiment illustrated) (page 134)

(5) Measuring the Lifting Force.

(6) Changing the lifting force.

(7) Pressures around propellers.

You will be evaluated upon your ability to participate in a discussion on these topics and on the Progress and/or LAP TEST.

4. After reading page 136 in your textbook, you will be able to list the trends of movement of air. After performing the experiment listed on page 136, under "Studying Air Currents", you will be able to explain by observation of the candle flame which way the air moves. This observation will be recorded in your notes.

5. After reading page 137 in your textbook, you will be able to define the term "streamlining" and list the significance of objects which travel at high speeds being streamlined.

Definition for "streamlining".

Significance of an object being streamlined.

Name some objects which can be classed as streamlined.

1. 3.

2. 4.

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You will be required to perform the above activities on the LAP and Progress Test.

6. After reading pages 138-139 in your textbook, you will be able to verbally explain to me why it is possible for odors to spread throughout a room when the air in the room is not moving.

Explanation:

You will be required to write this explanation on the LAP Test.

After reading, you should consult the World Book Encyclopedia, look up and read information about the composition of Air. Prepare a written copy of your findings and present them to the instructor for evaluation.

You will participate in a discussion on the topic "Composition of Air". You will be evaluated upon your verbal recitation on this topic.

7. After reading page 138 of your textbook and performing the experiment under the topic "Motion of Molecules", you will be able to explain why the odor of perfume and other odorous substances will spread throughout a room.

Why? Explain.

State in writing the molecular theory:

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On the LAP and Progress Test, you will be required to be able to explain some everyday applications or examples of motions of molecules of air. List several examples here for evaluation:

(1)

(2)

(3)

(4)

8. After reading page 139 in your textbook and performing experiment listed under the topic "Molecules in Moving Air", you will be able to explain in writing what happens in relation to producing high and low pressure in terms of:

Molecules:-

Pressure:

9. Perform the experiment - "The Power of Air Pressure."

10. Turn to page 144 in your textbook and answer questions 1-11. (Pass in your answers for evaluation). (Review Questions.)

11. Turn to page 144 in your textbook and answer questions 1-4 (thought questions) pass in your answers.

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*Perform this experiment on "The Power of Air Pressure"

Get a can, one like paint or varnish comes in, with a small cap that screws on (See your teacher) make sure the can is empty. Unscrew the cap, and pour in about a half a cup of water. Leave the top off. Heat the can over the hot plate until you see a lot of steam coming out of the opening at the top of the can. Using a pot holder or a towel, take the can off the hot plate and put it in the sink. Screw the top on tight. Turn on the cold water faucet, and let the cold water run over the can. In a few minutes the can will start to make noises as if it is collapsing. Within a minute or two, the can will collapse.

Explanation: When you screw the top on the can, there is nothing in it except water and steam. Then when you pour the cold water over the can, the steam is cooled and it changes to water. This leaves an empty space in the can, where the steam was. So there will be lowered pressure inside the can.

The air pressure outside is now much stronger than the pressure inside the can. The result-- the air from outside just squashes the can!

After performing and observing this experiment and studying the explanation, you will be required to be able to list the basic principles involved.

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SELF-EVALUATION II

1. Differentiate between an air pump and a vacuum pump.

2. Which of the above state pumps would you use to pump up a bicycle tire? _____ Why?

3. Which of the above-stated pumps would you use to remove air from an enclosed space?

_____ is the type of air pump used for raising the pressure of air.

5. When you heat an empty can, what happens to the air inside the can?

6. When the above stated can cools what happens?

7. Explain what happened and why with the Egg in a Bottle Trick.

8. What happened to the balloon on the top of the bottle on page 130 of your textbook as the steam began to condense? _____ Why?

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9. What happened to the can on the bottom of page 130 as the steam began to condense inside? _____ Why?

10. Under normal conditions, does slowing down air against a surface (increase or decrease pressure? _____

11. Under normal conditions does speeding up air (increase or decrease) pressure? _____

12. Study the top two diagrams on page 133. State what is going to happen in each case and why.

CASE 2

WHY

13. Explain the role air pressure above and below the wings play in lifting an airplane off the ground.

14. What is the meaning for the following terms:

a. air currents

b. streamline

c. molecules

d. molecular theory

SELF-EVALUATION II (cont')

15. Which direction does air tend to move (a) from regions of high pressure to regions of low pressure? OR (b) from regions of low pressure to regions of high pressure?

ANS. _____

16. Why is it important for an object to be streamlined in order to travel fast through air?

ADVANCED STUDY

1. Write a report entitled "The Importance of Changing Air Pressure."
2. List five different uses for each of the following:
   a. air pump
   b. vacuum pump
   c. compressor
3. Perform the experiments on page 138 in EPS at home and report your findings to the class.
4. State ... role air pressure, heat, and steam plays ... sealing the top of food jars.
5. Name several (at least 5) devices which operates due to the pressure exerted by moving air.
6. Prepare a display or a bulletin board which illustrates the changes that have taken place in the shape of the wings.
7. Collect pictures of racing cars to show the development of streamlined bodies.
8. Make a parachute (page 143 - EPS) and demonstrate the action of this parachute.
9. Make a chart which shows the air currents around an airplane wing.
10. Turn to page 143 - EPS - study the diagram at the bottom of the page. Set up the mystery apparatus shown at the right. Fill the upper can with colored water. Pour a cupful of water into the thistle tube to start it operating. Explain what makes the water keep flowing.

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LEARNING ACTIVITY PACKAGE

STARTING AND STOPPING

Ninety Six High School - Ninety Six, S.C.

PHYSICAL SCIENCE 92

REVIEWED BY _____

LAP NUMBER 6

WRITTEN BY G. J. Williams

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RATIONALE

Motion (Starting and Stopping)

Our world is a restless place. Everywhere forces act to set objects in motion or bring them to a stop.

Actually, everything on earth is in motion in regard to any fixed point in space. We may think we are sitting at rest in a chair, but because of the earth's rotation we are moving rapidly.

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Section 1

Forces for Starting and Stopping

Introduction: Our modern theory of motion states that a force must always act upon an object to set it in motion. Likewise, no moving object slows down by itself; a force must always act to slow it down and bring it to a stop.

Behavioral Objectives for Section 1

1. After using the dictionaries and the glossary of your textbook, you will increase your understanding of the scientist's language related to the study of motion, by stating the definitions for the terms listed under activity (1) for section 1, you demonstrate that you have learned the terms by completing a worksheet which requires the use of these terms.

2. After reading page 146 in your textbook, you will be able to state (in writing) the difference between positive and negative acceleration or (deceleration). You will demonstrate that you recognize the difference by identifying conditions as either positive (acceleration) or deceleration.

   Example: Identify the following as positive acceleration of deceleration.

   _____ (3) An automobile moving on a straight road goes from 35 mph to 45 mph in 5 seconds.

   _____ (4) Your car is slowed down from 50 mph to 20 mph in 6 seconds.

3. After listening to the lecture on acceleration, which will be given by your teacher, and learning the appropriate formulas, you will develop the skills needed for solving problems related to acceleration and deceleration. You will be required to solve similar problems on a Progress Test and the LAP Test.

Activities

_____ 1. Read page 145-152 in your textbook.

_____ 2. State in writing the definition for the following terms:

a. motion
b. acceleration
c. deceleration
d. friction
e. gravity
f. free fall
g. starting distance
h. follow-through
i. stopping distance
j. self-propelled
k. speed
l. velocity

_____ 3. Read page 146 in your textbook (write) the difference between (positive) acceleration and deceleration

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_____ 4. Take notes on lecture given on "Acceleration" by your teacher.

_____ 5. Learn these formulas and notations:

for problems on Acceleration

$$a = \frac{V_f - V_i}{t}$$

a = acceleration

V_f = final velocity

V_i = initial velocity

t = time elapsed

For negative acceleration

$$a = \frac{V_i - V_f}{t}$$

_____ 6. Enclosed are problems related to acceleration and deceleration.

(a) Identify the problem as either positive acceleration or as deceleration.

(b) Using the appropriate formula solve the problem for the amount of acceleration or deceleration.

_____ 7. Perform the following experiments - related to motion.

1. Falling Objects
2. A Force Gauge
3. Motion and Rest
4. Speed

_____ 8. Solve assigned problems related to the following concepts

1. Speed
2. Distance
3. Time

Perform the following experiment and answer the questions stated within the exercise.

Falling Objects

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In this investigation you will use simple equipment to test Aristotle's theory that the rate of fall is proportional to weight - in other words, the heavier an object is, the faster it will fall.

1. Fold a sheet of paper in half. Fold the paper in half again. Staple the four layers of paper together at the open corners.

2. Repeat this procedure using two sheets of paper.

3. Repeat this procedure using four sheets of paper.

4. According to Aristotle's theory, which of the folded papers should fall most rapidly?

5. Which of the papers do you think will fall most rapidly? Explain.

6. Hold the single folded sheet in one hand and the four folded sheets in the other. Release both at the same instant and determine the approximate difference, if any, in time required for each to fall to the floor. Repeat several times. Record your observations in your data book.

7. Repeat procedure 6, using two folded sheets and four folded sheets. Record your observations.

   A. Compare the results with the prediction you made at the beginning of the investigation. Make a general statement for falling objects based on your observations.

8. To determine whether the size of an object influences its rate of fall, fold the single sheet of paper in half two more times (for a total of four folds) and staple the open side. Then compare the rates of fall of this sheet and one folded in half twice.

   B. Does size influence the rate at which objects fall?
   Does weight influence the rate at which objects fall?
   Do light objects fall faster than heavy objects?
   Record your answers.

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Perform the following experiment and answer the questions stated within this exercise.

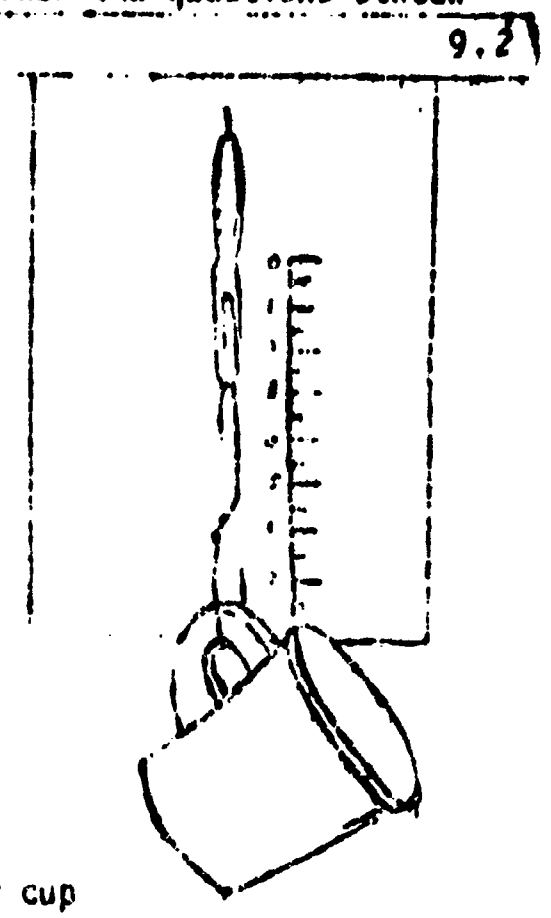
A Force Gauge

1. Tape the force gauge that you have made to a table or desk so that the rubber band, paper clips, and cup hang down along the scale on the card.

2. Read the position of the lower end of the rubber band on the scale. Be sure that your eye is level with the end of the rubber band when you take the reading.

3. In your data book prepare a chart similar to the one below.

4. Put one object in the cup, and record the scale reading. Add identical objects, one at a time and record the scale reading each time.



5. Remove all objects from the cup, and check to see that the scale reading is the same as it was when you began. If it has changed you will need to repeat procedure 4.

   A. Calculate the change in the length of the rubber band caused by each additional object. Record these changes in the third column on your chart. Look for a pattern in the changes.
      a. What is the pattern?
      b. What explanation can you give for the pattern?

6. Using a marble and steel ball find out how many times heavier the steel ball is than the marble. Would you predict that the speed of the steel ball will change more rapidly than that of the marble if the two are falling?

number of objects	scale reading	change in scale reading
1		
2		
3		
4		
5		
6		

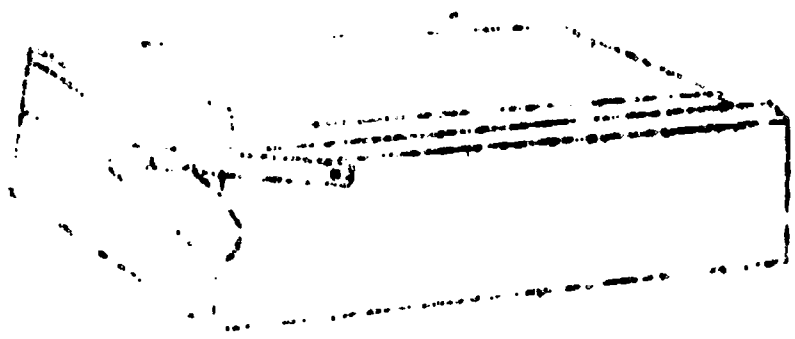
Perform the following experiment and answer the question stated within the experiment.

Motion and Rest

We know from experience that some kind of push is needed to make an object move. If the object is left alone, it stays at rest. It would appear that the natural condition of objects is rest, and that motion is achieved only with a push or a pull.

Is rest the natural condition of an object? What are some of the things that affect objects in motion and objects at rest? What kinds of measurements need to be made in a study of motion?

1. Place a grooved track on a level surface. Gently shoot a marble or steel ball along the groove. Observe and describe its motion. Does it come to rest, or does it keep moving?



2. Change the position of the track so that the ball must roll uphill. Shoot the ball and observe its motion. Change the position of the track so that the ball must roll downhill. Repeat the procedure. Record your observations.

A. Imagine that the track is very long and straight. If the slope is downhill, would you expect the angle of slope to affect the amount of time the ball will continue to roll? If so, how?

B. If the slope of the same track is uphill, would you expect the angle of slope to influence the amount of time the ball will continue to roll? If so, how?

C. What causes the ball to act as it does when the track is level?

D. What will happen if the ball is rolled with the same force along a level track that is smoother? Along a level track that is rougher?

E. If no forces act on the ball after the first push, what will happen to the motion of the ball? Why?

F. In your own words state a theory that might explain the natural condition of an object.

G. What are some of the factors that could affect the motion of an object?

H. What measurements must be made before the speed of a moving object can be expressed in numbers?

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Speed

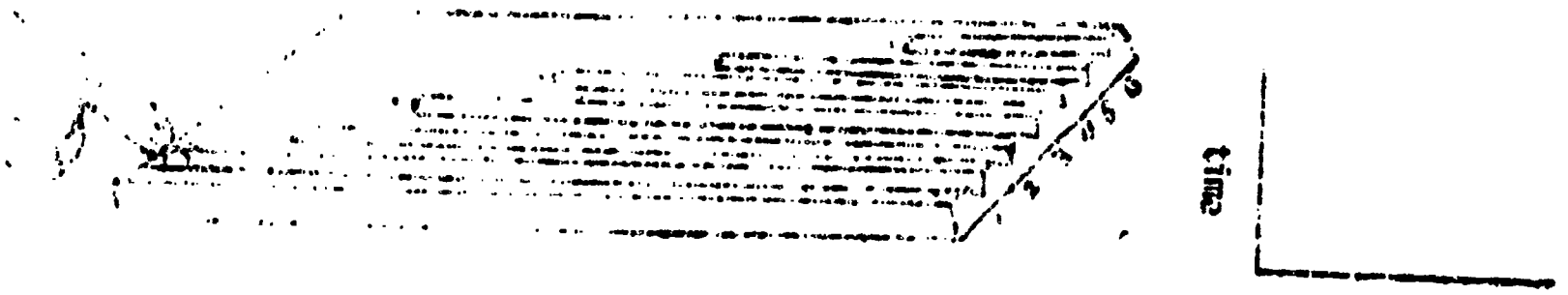
The term speed is part of your everyday vocabulary. We talk about the speed of automobiles, jet airplanes, and even the speed of sound and light. This investigation will show you a method of measuring speed.

1. Hold the steel ball against the starting post in track 1. Release the ball, and determine the time it takes the ball to reach the end of the track. Time can be measured with a click timer or a stop watch. Teamwork is important. It is best to make several trials, and calculate the average time for all trials.

2. Repeat the procedure, using tracks 2 through 6. Record the average time for each track.

3. Measure the length of each track in centimeters or inches.

4. Plot your results on a graph as shown below.



A. Compare your graph with the appearance of the speed track. Describe similarities and differences, and suggest an explanation.

B. Assume that s = speed, d = distance, and t = time. Explain each of the following equations:

1. $s = \frac{d}{t}$ 2. $d = st$ 3. $t = \frac{d}{s}$

C. Suggest ways in which the design of this investigation could be improved to yeild more accurate results.

D. In your own words write out a definition of speed.

E. What is your speed? Measure a distance and time that distance while your partner times you. How does your speed compare with other members of the class?

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Advanced Study

1. Read about the life of Issac Newton and report on his great contributions to the science of motion.

2. Find out about the stopping distances of automobiles traveling at different speeds and under different road conditions. Make a chart that summarizes your findings.

3. Prepare a report on the way jet planes and propelier driven planes are decelerated in the air and on the ground.

4. Prepare a write up of some conditions which affect the stopping distance of automobiles.

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Self Evaluation

Section I

1. Give a brief definition for the following terms:

   a. motion

   b. speed

   c. velocity

   d. stopping distance

   e. follow through

2. Differentiate between the following terms:

   a. acceleration

   b. deceleration

3. Write the formula you would use to calculate the amount of

   (a) acceleration _____

   (b) deceleration _____

4. Solve the following problems:

   _____ 1. Your car is accelerated from 75 mph to 100 mph in 5 seconds. What is your acceleration in mph/sec?

   _____ 2. Your car is slowed down from 80 mph to 20 mph in 20 seconds. What is your deceleration in mph/sec?

5. Idenfity the following symbols from formulas used for solving problems on acceleration and deceleration.

   (a) a =

   (b) V_f =

   (c) V_i =

   (d) t =

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Self Evaluation (cont.)

6. Summarize what happened with the experiment on "Falling Objects."

7. When performing the experiment using the force guage- what did you note, when you continuted to add identical objects one at a time? _____

   What happened when you started adding different objects one at a time? _____

8. [illegible] before an object at rest can be set in motion?

9. [illegible] factors which might influence the motion of an object once it has been set in motion.

   2. 3.

10. Write the formulas necessary to calculate the following:

    1. speed _____

    2. distance _____

    3. time _____

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Section II
Frictional and Gravitational Forces

Introduction: Why is it possible for you to move a book through the air more eaisly than you can push it across a desk? What role does friction play? After completing Section II you will be able to answer such questions as asked above also. You will learn what friction is, the different kinds of friction, and laws related to friction.

Behavioral Objectives IIA: Frictional Forces

1. After using the glossary of your textbook and defining the term friction, you will be able to state verbally on demand of the teacher and on the LAP and Progress Tests the definition for the term friction.

2. After reading page 146 in your textbook and performing the demonstration under the topic "Effect of Friction", you will be able to participate in a discussion on the topic "Effect of Friction and Acceleration". You will be evaluated upon your participation in the discussion.

3. After reading World Book Encyclopedia Book F, page 458, you will be able to perform the following activities.

X a. State why it is easier to lift an object than to pull the same across a flat surface.

X b. List four uses for friction.

X c. List two disadvantages of friction.

X d. List three ways that friction can be reduced.

X e. List the names and an example of three different kinds of friction.

X f. State the basic law of friction and give a brief explanation of this law.

X g. Give the definition for the term coefficient of friction.

X h. Give the formulas necessary to calculate the following

1. coefficient of friction
2. friction

i. State two sample problems. (a) to show how you would solve a problem for the coefficient of friction, and (b) how you would solve a problem calculating the amount of friction.

You will be evaluated upon these activities by your verbal response to questions related to these activities and those marked with an (X) will appear on the LAP and/or Progress Test.

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4. After completing activities B, C, D, and F for Behavioral Objective 3, you will prepare a poster of one of the following topics:

   a. Uses for Friction
   b. Disadvantages of Friction
   c. Reducing Friction
   d. Kinds of Friction

   You may prepare your poster on unlined paper. Your poster will be evaluated upon content, neatness, presentation, and your understanding of the information on your poster.

Behavioral Objectives IIB: Gravitational Forces

Introduction: When you jump up what happens to you? What pulls you down? When you throw a ball into the air what happens to it? What pulls on the ball? After completing this part on section II of the LAP, you will learn the role that gravity plays [illegible]

5. After using a good dictionary you will be able to state a good definition for the term gravity. You will be required to identify this definition on the Progress and LAP Test.

After reading page 146 in your textbook and performing the exercise on the topic "Effect of Gravity", you will be able to observe the effect of gravity on acceleration. You will be evaluated by your responses to the questions that are asked in the same topic.

After reading pages 321-323 in the World Book Encyclopedia Book G, you will be able to perform the following activities.

X a. State the role of the sun's gravitation.

   b. State what holds the hot gases together in a star.

X c. State what causes tides.

   d. State what holds the moon in its orbit.

X e. List four things that would happen if gravitation could be turned off.

   f. State Newton's Law of Gravitation.

X g. Differentiate between the terms mass and weight and state which one changes with different positions in the universe.

X h. State the definition for the term center of gravity.

   i. Illustrate how one can find the center of gravity of an irregular shaped object.

X j. State the definition for the term specific gravity.

   k. Illustrate how one can determine the specific gravity of any material.

You will be evaluated upon the following activities by your responses in the discussion of center of gravity. Those that are marked with (X) will appear on the Progress and LAP Test.

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l. Differentiate between mass and weight.

m. Which one changes with different positions in the universe. Mass or weight?

n. There is less gravity on the moon than on the earth, Would a person weigh more or less on the moon as compared to the earth?

o. Would a rocket require greater or less force to escape the earth's gravity?

Activities - Section II

1. Define the following terms:

1. [illegible]	6. [illegible] Velocity
[illegible]	7. Inertia
[illegible]	8. Tide
[illegible]	9. Mass
[illegible]ity	10. Weight

2. [illegible] experiment under the topic "Effect of Friction" on [illegible] your textbook EPS.

[illegible] Book Encyclopedia Book F, page 458 and answer questions A-I in the Behavioral Objective section. (Review these concepts)

4. Prepare a poster on one of the following topics.

1. Uses for friction
2. Disadvantages of friction
3. Reducing Friction
4. Kinds of Friction

5. Complete the following worksheets related to friction.

1. Friction
2. Useful friction
3. Reducing Friction

6. Observe the filmstrip: 1. Gravity- Inertia- Friction

7. Perform the following experiments

1. Direction of Motion
2. Friction
3. Different Kinds of Surfaces and Friction

8. Review your definitions for the following terms. (You should have them already)

1. Gravity	4. [illegible]
2. Escape Velocity	5. Mass
3. Inertia	6. [illegible]

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9. Use the World Book Encyclopedia pages 321-323 Book G and answer the questions about Gravity.

10. Select any phase which interests you about either gravity or friction and prepare a report. Pass in for evaluation.

11. Take your self evaluation.

12. Prepare an advanced study.

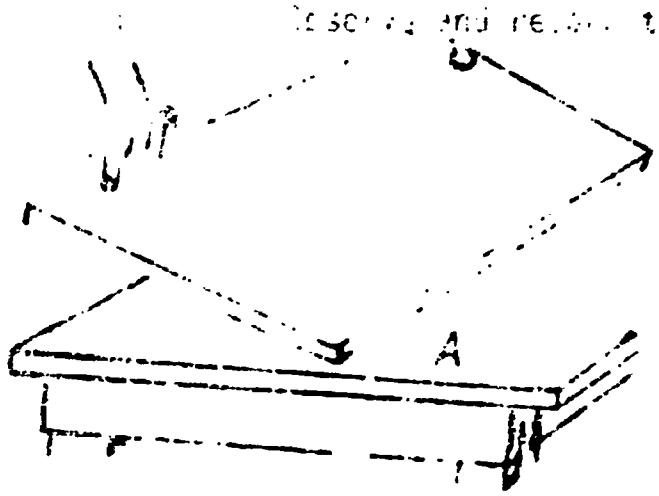
13. Take your Progress Test.

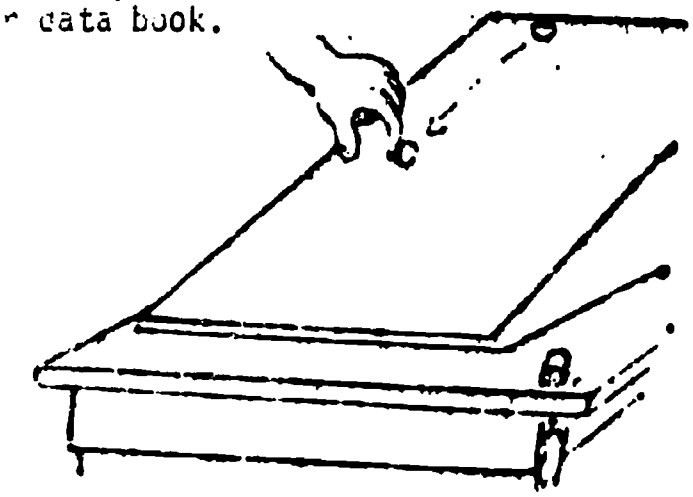
Perform the following experiment and answer the questions stated within this exercise.

Directions for

1. [illegible] a piece of hardboard. Shake a thin film [illegible] on the hardboard and then holding it as shown in [illegible] trace the path of the marble from the top of the [illegible] How do you suppose the marble will be influenced so [illegible] straight line?

2. [illegible] the board as shown in B. This time barely touch the [illegible] and release. Trace the path in your data book.

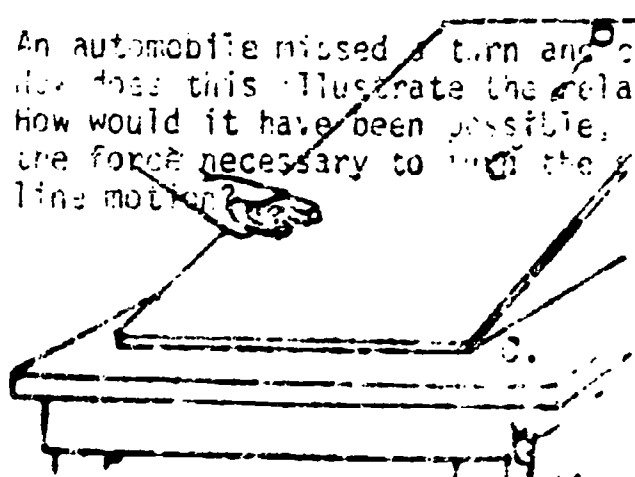




3. This time hold a magnet at the edge of the board as shown in picture C. Draw the path of the marble in your data book.

4. Is there a single statement that describes all of these ways of changing the direction of motion? What is it?

5. An automobile missed a turn and crashed through the guard rail. How does this illustrate the relation between force and motion? How would it have been possible, in such a situation, to provide the force necessary to [illegible] the car away from a straight line motion?



7. An entertainer jerked a tablecloth out from under the dishes. The dishes did not fall off the table. How does this illustrate the principle of inertia?

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Perform the following experiment and answer the questions stated within this exercise.

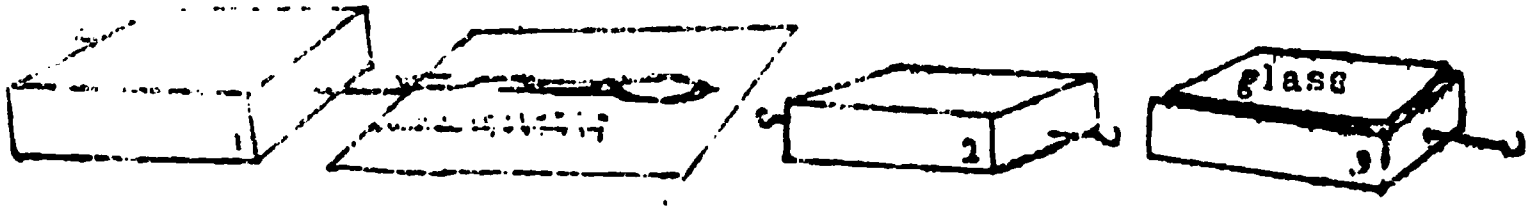
Friction Play tape 2 (507-529)

A. Lay the force guage on the desk or table, and straighten out the rubber band and paper clips. The free end of the second clip should extend beyond the edge of the guage. Pick up the free end and hold it so that the rubber band is straight but not stretched. Record the scale reading (at the end of the rubber band.)

B. Number the blocks as shown. Place block 1 on the sandpaper, with one of the large sides down. Attach the free end of the force gauge so that the block slides at a steady speed over the sandpaper. Take a reading on the force guage scale. Record.

C. Place the block on the pane of glass (same side down.) Pull on the force guage so that the block slides at a steady speed. Record the reading on the force guage scale.

1. Wood is made from melted sand. How can you explain the difference between the force required to pull wood over sandpaper and the force required to pull wood over glass?



2. How can this difference in force be related to the structure of matter?

D. Turn block 1 so that one of its smaller sides is down. Do you think it will require more, less, or the same amount of force to pull the block in this position as compared with the force required in procedure C? Write down your prediction. Now test your prediction by pulling the block over the glass. Pull on the force guage so that the block slides with a steady speed. Record.

3. Is the amount of friction between objects related to the area of the surfaces in contact?

E. Lay 2 glass rods or tubes parallel to each other (about 1 inch apart) on the pane of glass. Put block 1 on tope of them and pull it with the force guage so that it rolls with a steady speed. Record the reading.

4. Make a sketch showing the motion of particles of wood and glass in procedure D. Make another sketch showing the motion of particles of wood and glass in procedure E.

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Perform the following experiment and answer the questions stated within this exercise.

Does the kind of material that makes up the surfaces in contact affect the amount of friction?

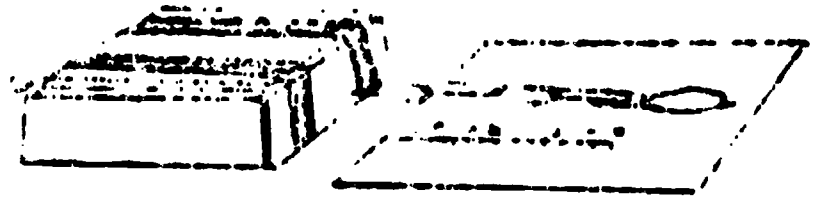
1. Place block with glass furface side down on the pane of glass. Measure the force required to slide the block at a steady speed across the plate of glass. Record the reading on the scale.

2. Turn the block over so that the glass surface is up. Use the force gauge to pull the block at a steady speed on the glass plate. Record the reading.

3. Put 2 rubber bands around the block as shown. Be sure the rubber bands are not twisted. With the rubber bands acting as runners, pull the gauge so that the block moves at a steady speed over the glass pane. Record the reading.

A. List several properties of rubber that you think make it useful for vehicle tires.

4. Remove the rubber bands and replace them with 2 pieces of masking tape. Be sure the sticky side of the tape is out. Try to pull the block over the glass at a steady speed with the gauge. Record your observations.



B. Explain the result of procedure 4 in terms of the behavior of the particles that make up the surface of masking tape. You will want to take into account both the shape (roughness) of the surface and the type of material involved.

5. Prepare a chart. Use your force gauge to measure the force needed to pull block 1 at a steady speed on a smooth level surface, such as a counter top. Repeat, using blocks 1 and 2 hooked together, one behind the other. Record the reading and repeat, using all three blocks hooked together, in single file.

6. Unhook the second and third blocks. Place block 2 on top of block 1. Pull the 2 blocks over the same surface used in procedure 5, and record the reading. Then stack the third block on top of the others. Pull the three blocks and record data on the chart.

C. Does the amount of friction depend on the area of the surfaces in contact? Does it depend on weight?

	BLOCKS	SCALE READING
	1	
Hooked together	1 + 2	
	1 + 2 + 3	
Stacked	1 + 2	
	1 + 2 + 3	

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Self Evaluation
Section I:

1. Define friction.

2. State how friction affects acceleration.

3. Explain why is it easier to lift an object rather than to push it across a surface.

4. List two uses for friction.

   a.

   b.

5. What is two disadvantages of friction?

   a.

   b.

6. List the names of two different kinds of friction.

   a. b.

7. What is meant by coefficient of friction?

8. Define gravity.

9. Explain how gravity affects acceleration.

10. What force holds the planets in their orbits?

11. Explain what causes tides.

12. If gravitational force was suddenly cut off, list three things that would happen.

    (a)

    (b)

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Advanced Study

1. Prepare a report on the "Advantages and Disadvantages of Friction."

2. Make a chart which compares different kinds of surfaces which offers little or no friction with those which offer a lot of friction.

3. Make a chart or display of a list of lubricants or means of reducing or preventing friction.

4. Make a report on the roles "Gravity Play in our Universe."

5. Make a chart which displays either and/or some advantages or disadvantages of friction.

6. Make a chart which displays some effects of gravity.

7. Make a report which contrasts the amount of gravity on the earth with the amount on the moon.

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Section III
Starting and Stopping Distances

Behavioral Objectives:

1. After reading page 152 in your textbook, you will be able to state in writing what is meant by starting distance. You will be required to state the definition in writing on the Progress Test and LAP Test.

2. After reading page 153 in your textbook under the topics--Bows and Arrows and Varying Starting Distances, you will be able to provide answers to the questions that are stated under each section. You will pass in this exercise and you will be evaluated upon the answers you have provided.

3. After reading page 154 in your textbook you will be able to make a comparison between blow guns and firearms in terms of length of barrel, gas pressure, and bullet speed.

You will be evaluated upon the comparison you present.

4. After reading pages 148-149 in your textbook and performing the experiment under the title-Acceleration of Falling Objects, you will be able to state what happens during the experiment in terms of

   a. The downward pull of gravity
   b. The upward pull of the cord
   c. The friction of the pulley

You will be evaluated by the explanations you give for what happens on the Progress and LAP Test.

5. After reading pages 148-151 in your textbook, you will be able to provide the answers to the questions on the worksheet related to "Forces for Starting and Stopping". You will be required to learn the answers to questions marked by (X) they will appear on the PROGRESS AND LAP TEST.

Activities

1. Read and summarize the information which is covered on pages 148-152 in your textbook EPS.

2. Perform the activities as they are stated in Objectives 1, 2, 3 and 4.

3. Complete the enclosed worksheet on "Forces for Starting and Stopping,"

4. Perform the experiment - Play Ball- and answer the questions stated within the exercise.

5. Take the self evaluation.

6. Prepare an Advanced Study.

7. Go to Section 4.

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WORKSHEET

Forces for Starting and Stopping

X 1. Name the two forces that act on a parachute as it decends.

(a) (b)

2. What direction do these forces act?

(a) (b)

X 3. Which of these forces is an

(a) accelerating force

(b) decelerating force

X 4. What would happen to the parachute in each of the following cases:

(a) Downward force greater than upward force?

(b) Upward force equals the downward force?

X 5. When is the term free fall used?

X 6. Why is free fall impossible in air?

7. If you were presented with the following data related to bathroom scale reading:

Normal Reading	Reading with Knees bent	Reading with Rising Slowly	Reading while Rising Fast	Reading While Rising Very Fast
114	114	121	128	140

(a) When is the greatest force exerted? _____ (b) What method of straightening up requires the lease muscular effort? _____ Why?

8. Refer to page 151. Read section - Behavior of a Tossed Ball. Make a sketch of the diagram and lable as shown: A, B, C, D.

X a. Label where accelerating forces act on the ball.
b. What direction does gravity act on the ball? Upward or downward?
X c. From B to C, gravity and air resistance act as (Accelerating, decelerating) forces.
d. The only force acting on the bass at C is _____.
e. The force acting on the ball at C causes the ball to _____ _____.
f. The two forces acting on the ball from C to D are _____ and _____.
g. From C to D, the ball (accelerates, decelerates, moves at a steady speed)?

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9. After studying the diagram at the top of page 155, and reading the section "Pitching a Baseball" you will be able to complete the following:

X a. When does a pitched baseball reach its greatest speed? _____
X b. Why is it that a pitched baseball does not gain speed after leaving the pitchers hand?
X c. What is the advantage of starting a pitch far behind the head of the pitcher? _____

d. Which has the greater starting force A to C or A to B?

_____ Why? _____

X e. What is the advantage of having a long armed pitcher?

f. After leaving the pitcher's hand, the ball is (accelerated, decelerated, or moves at a constant speed)?

10 Study the diagram at the top of page [illegible] and read the Section on Driving a Golfball.

Assume that the data for the motion of the golf club was as follows:

Time Interval	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Distance Moved(mm)	7	9	8	9	11	12	13	15	18	20	17	17	15	14	13	12

Time Interval	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Distance Moved(mm)	11	11	10	10	10	9	9	9	8	8	7	7	6	5	5	5	5

Time Interval	34	35	36	37	38	39	40
Distance Moved(MM)	5	5	5	5	5	5	5

Construct a broken line graph for this data. Plot the distance moved on the vertical axis and the time interval on the horizontal axis.

From your graph interpret the following:

X a. When was the golf club moving most rapidly? _____

b. The apparent bending of a club results from what?

You will be evaluated upon your graph and interpretations.

X 11. Read page 157 - Topic - "Follow Through"

a. State in writing the purpose of follow-through.

b. List several sports that require follow-through for their success.

c. State the purpose for follow-through.

You will be evaluated upon this activity on the Progress and LAP Test as it is stated.

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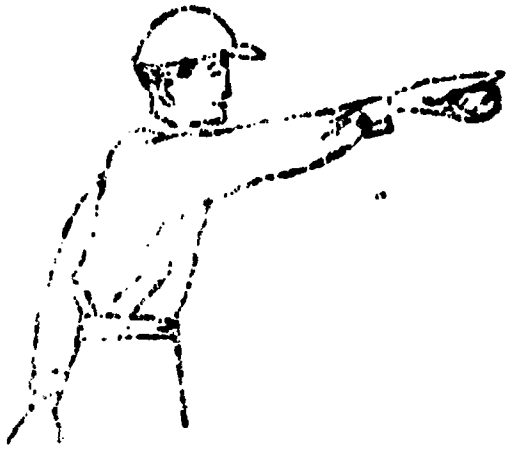
Perform the following experiment and answer the questions within.

Play Ball Play Tape 2 (605-722) This is a tape of the World Series in the year 2000.

1. Throw a ball up in the air. Does it go very high? How could you make it go higher?

2. Throw it up again. Watch very closely. When does the ball move fastest? When does the ball move most slowly? Do you think it ever stops in the air?

3. Throw the ball to a partner. Does the ball go straight from you to your partner? What do you feel when you catch the ball?



4. When you throw the ball from one person to another, what would happen if no one caught it? If nothing was in its path to stop it what would happen to the ball?

5. What caused the ball to move? force

6. What keeps it going? inertia

7. What slows it down? friction

A. Put your hands together like this - PUSH! What do you feel? (a force?)
Hook 2 forefingers together -- PULL! What do you feel?
What was the direction of the force put out by the right hand? by the left hand?

B. Stand up and jump - can you feel a force pulling you down?

C. Do you think the following statements are true? Give evidence for your answer.

1. Nothing will move unless some force is applied.
2. If an object is moving, it will continue to move unless some force stops it.

3. An object in motion will continue to move in a straight line unless some force causes it to change its direction.
(Example: pitcher → Batter
↙ fielder
What caused the ball to change direction?

How much work do you do when you indian wrestle and both hands are straight up?

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Self Evaluation
Section III

1. What is meant by starting distance?

2. Where does the starting distance of an arrow begin? end?

3. At what instant does an arrow have it greatest speed?

4. Differentiate between a blow gun that operates by lung pressure and those that use the pressure of hot gases.

5. What two forces act on a parachute as it decends?

   (a)

   (b)

6. In what direction does the force of gravity pull?

7. What is meant by the term free fall?

8. Why is free fall impossible in air?

9. Would the forces of gravity and air resistance be considered as accelerating or decelerating forces?

10. When does a pitched ball reach its greatest speed?

11. What is the advantage of starting a pitch from behind the head of a pitcher?

12. After impact when is a golf ball moving most rapidly?

13. What is the purpose of follow-through?

14. Name several sports that require follow through for their success.

15 What is the meaning of follow-through?

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ADVANCED STUDY

1. Write a report which includes why it is important to "follow through" in the following sports:
   a. Baschall
   b. Bowling
   c. Golfing
2. Make a poster which displays some examples of some
   a. Accelerating Forces
   b. Decelerating Forces
3. Write a report which includes some disadvantages of decelerating forces.
4. Read about the methods that skiers use to decelerate themselves when they find they are going too fast or when they want to stop. Make a diagram of each method.
5. Prepare a display or diagram which shows when cars on a roller coaster are accelerating and when the cars are decelerating.

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Section IV
Stopping Distance

Introduction: Just as an object is set in motion by an accelerating force, an object is brought to rest by a decelerating force. Nothing stops instantly.

Behavioral Objectives:

1. Study the diagram at the top of page 158 in your book. You will see that there must be a stopping distance to bring an object to a stop.

   Did the car stop instantly? _____
   Explain your answer.

   Consult a driver's handbook on page 42 and make a poster showing stopping distances for different speeds with good brakes. Your poster will be evaluated by content, neatness, [illegible], and presentation.

2. Perform the experiment under the topic "Changes in Stopping Distance". Record your data here.

Landing Method	Resulting Force Pain	Relative Stopping
1. Knees stiff		
2. Knees bent a little		
3. knees bent a few inches		
4. knees bent several inches		

   You will be evaluated upon the data that you record.

3. Study the diagram at the bottom of page 159. Read the section Landing From a Jump. Answer the questions listed under that topic; you will be evaluated upon the answers you give for the questions in a discussion.

4. Study the way a baseball catcher slows down a fast pitch. Give a description of how he does it and tell why he uses this procedure. You will be evaluated upon the description of procedures that you present.

5. Observe the diagrams on page 161 at the side. After reading the section on boxing both from your textbook and the "B" volume of the World Book Encyclopedia, Explain: "Rolling with the punch in terms of stopping distance and decelerating force."

   Explain what happens if a boxer doesn't "roll with the punch" in terms of stopping distance and decelerating force.

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You will be evaluated upon your ability to explain the significance of rolling with the punch in terms of stopping distance and decelerating force.

6. Read pages 162-165. List the two parts that the swing of a hammer can be divided into. State the purpose of hammer handles. Differentiate between using large and small hammers in terms of producing large forces. You will be evaluated upon this activity as stated on the Progress and LAP Test.

7 List and learn the names of five devices that belong to the pounding tool family and explain briefly how they operate in terms of starting and stopping distance.

8. Why does a gun "kick" when you pull the trigger? Consult a Modern Physical Science book by Brooks, Tracy, Tropp, and Friedl. List the names of five devices that operate on the action-reaction principle. State the principle. You will be required to list at least four devices that operate on action and reaction principle on the LAP Test and Progress Test.

9. The formula for calculating the answers to problems dealing with action-reaction (momentum) is $M_1 X V_1 = M_2 X V_2$
Interpretation: M = mass
V = velocity
The subscripts 1 and 2 indicate which objects are acting and reacting. Learn the basic formula and study this sample problem:

A gun having a mass of 500g fires a 5g mass bullet at a speed of 1000 meters/sec. Find the recoil speed of the gun.

Solution:

Step 1 - Substitute the given quantities in the equation

$M_g X V_g = M_b X V_b$

M_g = mass of gun; V_g = velocity gun; M_b = mass of bullet; V_b = velocity bullet go

$M_g = 5000g$ $\qquad M_b = 5g$

$V_g = ?$ $\qquad V_b = 1000$ m/sec.

$M_g X V_g = M_b X V_b$

$(5000\ g) X V_g = (5_g) X 1000$ m/sec.

Step 2. Solve for V_g in this equation.

$$V_g = \frac{(5_g) X (1000 \text{ m/sec.})}{5000\ g}$$

OR $V_g = 1$ m/sec.

Activities

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1. Read pages 158-165 in your textbook EPS.
2. Perform the activities as stated in Ojbectives 1, 2, 3, 4, 5, 6 and 7.
3. Make a poster which displays different stopping distances at different speeds. (consult a drivers handbook for this)
4. Make a list of tools which belong to the pounding tool family. (Bring in pictures of these tools if they are available.)
5. Find the meaning for the term moment..., and what the statement for every action there is an equal and opposite reaction means.
6. List the names of five devices which operate on the action reaction principle.
7. Observe the demonstration on how to solve problems related to momentum.
8. Solve the assigned problems related to momentum.
9. Observe the following filmstrip
   1. Transportation by Air
   2. Transportation on Water

   (State how these filmstrips are related to the study of momentum)
10. Perform the following experiments.
    1. A jet propelled boat
    2. Self Propulsion
    3. Reaction engine
11. Take the Self Evaluation
12. Do an advance Study
13. Take the LAP Test.

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Perform the following experiment and answer the questions stated within the exercise.

A jet propelled boat

Every action produces a reaction equal in force and opposite in direction.

Build a jet propelled boat. You may use any design that you wish, but it must meet 2 qualifications:

1. It must not be longer than one foot.
2. It must be able to go backwards as well as forward.

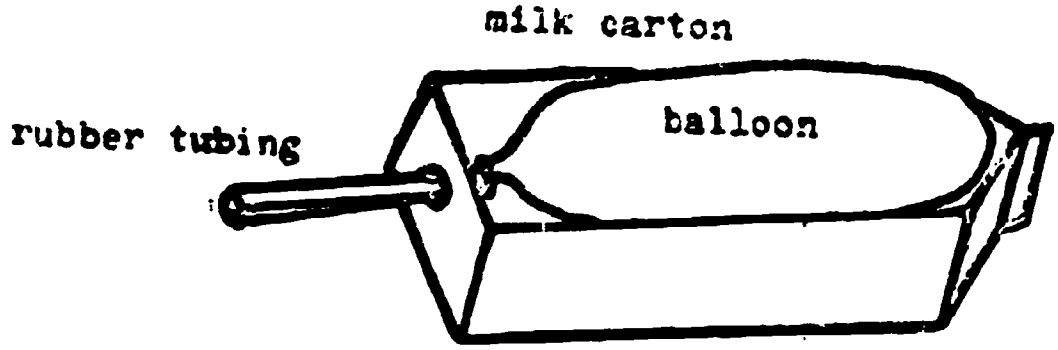
A sample model can be seen below or you may use your own imagination.

Get a group of your friends to build boats also. Then set a time and after discussing this with your teacher, plan a boat race.

Jet propelled airliners do not have propellers. How can a jet airliner slow down its landing speed?

Could changing direction of exhaust gases solve this problem?

Can you suggest a way to slow down a jet so that extra long runways are unnecessary.



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Perform the following experiment and answer the questions stated within the exercise.

Self-Propulsion

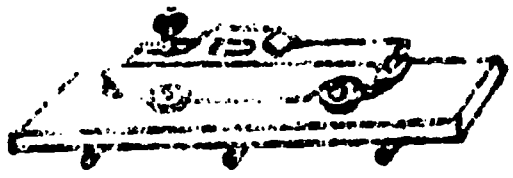
Physicists have learned that for every force there is an equal and opposite force. They call these forces action and reaction.

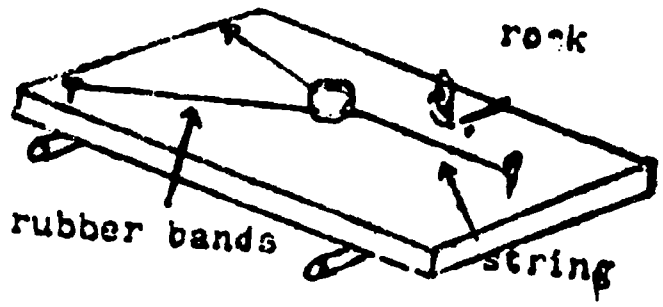
1. Wind up a toy car and set it on a thin board that rests on rollers. What happens when you hold the car still? What happens when you hold the board still? What happens when you do not hold either the car or the board? Discuss the forces applied in each case.

2. Make the device shown below and find out what happens when you burn the string. Test stones of different weights. What happens when the stone and the board weigh the same?

3. Change the accelerating force by using rubber bands of different thicknesses. Test the effect of adding different loads to the board.

4. A boy on a scooter needs a forward push to drive himself ahead.

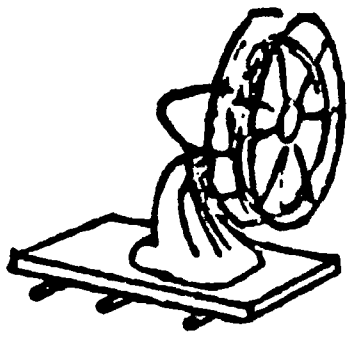




He can get this forward push by pushing backward on the sidewalk. The sidewalk then pushes forward on him and rives the scooter ahead. The ground is able to provide a forward push because of friction. What would happen if the boy tried to ride his scooter on very smooth ice?

5. Propellers exert a backward push on the air. As the propellers push backward on the air, the air pushes forward on the propellers. The forward force is the force of reaction. The force of reaction on a propeller can be demonstrated with an electric fan.

6. Place the fan on a light board that rests on round sticks. Hold the board from moving and start the fan. Note that the fan is pushing the air away from it. Release the board. What happens? Explain the behavior of the fan and the board in terms of action and reaction.



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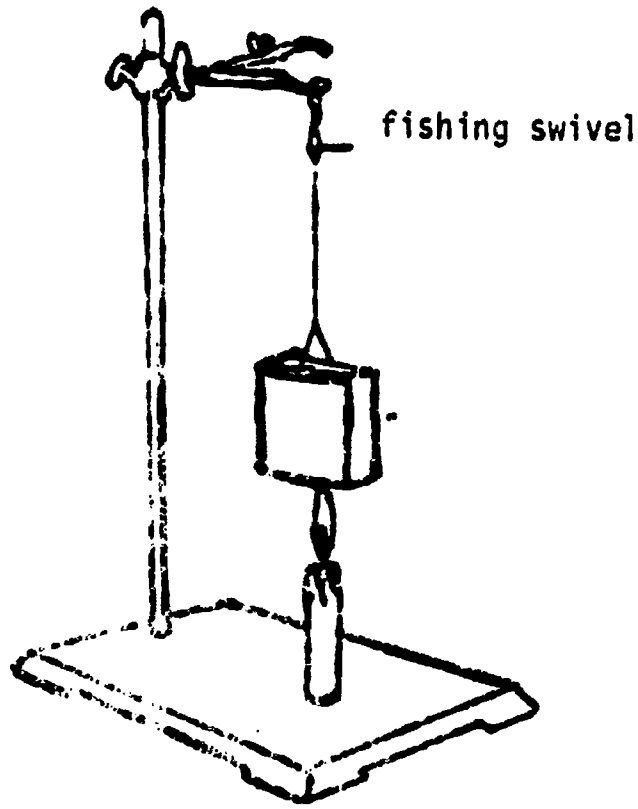
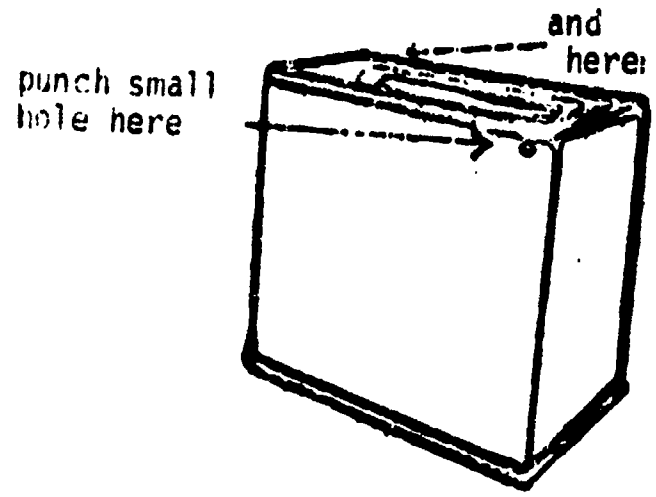
Perform the following experiment and answer the questions stated within this exercise.

Reaction engines

1. Get a small tin can with a press-on lid (a medium size spice can works well.) Use a nail to punch holes in the upper corners of the can near the top, as shown.





2. Put 5 to 10 ml of water inside the can. Tie a loop of fine thread around the cover, and push the cover into place.

3. If your can is different from the one shown, you may need to modify your method of hanging it. Hang the can by the thread. Be sure the thread is untwisted and the can is hanging without turning.

4. Place a candle under the can and wait for the results. Observe the direction in which the steam comes from the hole and the direction in which that part of the can moves. Why are the holes placed in the corners of the can instead of in the center?

5. What will happen if the jet is allowed to thrust against an immovable piece of board?

6. Can you devise an arrangement that will allow the thrust of 2 steam jets to be compared? One steam jet from a can should be pushing against some solid surface, while the other steam jet is thrusting against thin air. Be sure that the jet holes are the same diameter.

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Your Problem

If a 10 lb. gun fires a 1 oz. bullet at 1600 ft/sec., what is the recoil speed of the gun? Show your work here!

10. Read pages 168-171. Briefly explain how the following operate in relation to the action and reaction principle.

(a) propellers

(b) jets and rockets

You will be evaluated upon your ability to describe how these objects operate in relation to the action and reaction principle.

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Self-Evaluation
Section IV

1. What is meant by stopping distance?

2. What will happen if a moving object does not have an adequate stopping distance between the time the decelerating force is applied and the time the object is reached?

3. Should a baseball be decelerated slowly through a long distance or quickly through a short distance?

4. In the sport "boxing" what is meant by "rolling with the punch"?

5. Name four tools that belong to the pounding tool family.

   a. c.

   b. d.

6. If one wanted to produce a large force to pound a nail into a flat surface, would he use a long handled or short handled hammer?

7. State the action-reaction principle.

8. List the formula for calculating the momentum of an object.

9. Name four devices that operate on the action-reaction principle.

   (a) (c)

   (b) (d)

10. Solve this problem:

    A gun having a mass of 5000 g fires a 5 g mass bullet at a speed of 1000 meters/sec. Find the recoil velocity of the gun.

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Advanced Study

1. Prepare an exhibit of common pounding tools including those used in the home, in small shops and in athletics.

2. Prepare report on how "rolling with the punch is important in boxing.

3. Prepare a write up on how "follow through" is important in the following sports:
   1. Baseball
   2. Bowling
   3. Golf

4. Prepare a summary including a description and use for the following tools.
   1. Drop Forges
   2. Pile Drivers
   3. Skull Crackers

5. Prepare a write-up which includes some of the advancements due to self-propulsion.

6. Write a summary which includes how the shapes of objects affect the rate at which they travel through the air.

7. Summarize how gravity and friction affects objects as they travel through the air.

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LEARNING ACTIVITY PACKAGE

MACHINES

Ninety Six High School
Ninety Six, S.C.

SCIENCE 92

REVIEWED BY J.S.R.

LAP NUMBER 7

WRITTEN BY G. J. Williams

R A T I O N A L E

Throughout history man has learned ways to increase force, change the direction of a force, and increase the speed of his work.

A machine is a device that helps us do these things. We do not know what the first machine was. It may have been the tree branch the caveman used as a lever to move a huge stone, or the sharp rock he used as a scraper (wedge) to skin animal hides.

Scientists have identified six simple machines, the lever, inclined plane, pulley, wheel and axle, wedge and screw.

In this LAP, we will be concerned with names, description and some uses for the six simple machines and how they are combined to make complex machines.

Section I

General Introduction to simple machines.

BEHAVIORAL OBJECTIVE I A

After completing the assigned activities, you will be able to state the name, recognize, identify a use and describe the six simple machines.

Activities

1. Define the following terms

1. machine	6. pulley
2. simple machine	7. wheel and axle
3. complex machine	8. screw
4. efficiency	9. incline plane
5. lever	10. wedge

2. Read and summarize the information found on pages 184-193 in the EPS textbook.

3. Complete the student activities on the following worksheets.
   1. Simple Machines
   2. Complex Machines
   3. Incline plane
   4. Screw
   5. Wedge

4. Write down and learn the names of the six simple machines. (if necessary make a sketch so that you can identify the machines when you see them again)

5. Differentiate between a complex and a simple machine. List several examples for each one.

6. Observe the filmstrip "Simple Machines" (Summarize the contents)

7. State several advantages for using a machine.

Self Evaluation

1. Define the term machine.

2. Differentiate between the following terms.

   1. simple machines
   2. complex machines

3. List the names of two complex machines.

   1. 2.

4. List the names of the six simple machines.

   1. 4.
   2. 5.
   3. 6.

5. List two advantages of using a machine.

   1.

   2.

6. Identify the simple machine by its description.

   a. a sloping surface_____

   b. a rope slung around a wheel _____

   c. a rigid bar pivoting on a fixed point _____

   d. a spiral incline plane_____

   e. wheel connected to a shaft_____

7. Name four devices which contain the wedge.

   1. 3.
   2. 4.

8. List the names of some simple machines which are found in the following complex machines.

   1. typewriter _____,_____,_____

   2. wheelbarrow _____,_____,_____

Self Evaluation (cont.)

3. scissors _____,_____,_____

9. Name several devices which contain a wheel and axle.

   1.

   2.

10. Name a common use for incline planes.

Advance Study

1. Make and display examples of simple machines, such as levers, incline planes, wheel and axles and pulleys.

2. Make a display of several complex machines and label the names of the simple machines which can be found on or within the complex machine.

3. Make a display of some toys which utilize simple machines.

4. Make a report about one of the simple machines, include pictures, etc.

5. Find out what is meant by the following terms in relation to a machine.
   1. Mechanical advantage
   2. Efficiency
   3. Friction effects and how it can be reduced.

Section II

The study of the simple machine, the lever.

BEHAVIORAL OBJECTIVE I A

After completing the following activities, you will be able to differentiate between, relate daily examples for, and solve problems related to the first, second and the third class levers.

BEHAVIORAL OBJECTIVE I B

After completing the enclosed worksheets on the incline plane and general information about machines, you will be able to solve problems related to the incline plane and state uses for some of our common simple machines.

ACTIVITIES

_____ 1. Define the term lever.

_____ 2. Draw a sketch and label the three classes of levers (pages 194-197 of your textbook)

3. Learn the differences between the first, second, and third class of levers.

_____ 4. Study the sample problems related to levers (listen to lectures)

_____ 5. Solve problems assigned, related to levers (all three classes)

_____ 6. Complete the enclosed worksheet on general information about levers.

_____ 7. Read information on pages 186-187 of your textbook about the incline plane (learn symbols on page 186).

_____ 8. Study the sample problem related to the incline plane and mechanical advantage.

_____ 9. Solve assigned problem on the incline plane and mechanical advantage.

_____10. Complete the enclosed sheet on general information about machines learn those with an X by them.

_____11. Observe the film "Simple Machines Make Work Easier."

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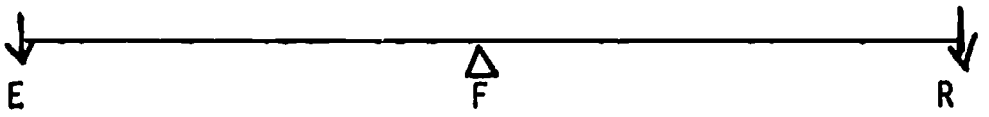
Problems Related to Levers:

To which class of levers does the following lever belong? _____



Does the following lever resemble a seesaw?_____

At this point: Look up and write down the Law of Moments.

Sample Problem related to the first class lever:

Problem: Is it possible for a 78 lb. boy who sits 4 ft. from the fulcrum to balance a 52 lb. boy who sits 6 ft. from the fulcrum?

Formula: counterclockwise moment = clockwise moment
Force X Distance = Force X Distance
78 lb. X 4 ft. = 52 lb. X 6 ft.
312 ft/lb. = 312 ft/lb

Answer to problem = YES

Your Problems Related to the First Class Lever

I. If a 150 lb. man were to sit 4 ft. from the fulcrum of a seesaw, how far from the fulcrum must a 100 lb. boy sit to balance him? SHOW YOUR WORK HERE!

II. An 80 lb. boy is sitting 6 ft. from the fulcrum of a seesaw and a 100 lb. boy is sitting 4 ft. from the fulcrum on the same side as the 80 lb. boy. How far from the fulcrum would a 220 lb. man have to sit to balance the two boys? SHOW YOUR WORK HERE!

Problems Related to the First Class Lever (cont.)

III. A 150 lb. boy is sitting 2 ft. from the fulcrum of a seesaw and a 100 lb. boy sits 3 ft. from the fulcrum. Is the seesaw balanced? SHOW YOUR WORK HERE!

IV. A weight of 500 g. hangs from a uniform lever 20 cm. to the right of its midpoint fulcrum. At the left is 250 g. weight 20 cm. from the fulcrum, and a 100 g weight 50 cm from the fulcrum. Is the rod balanced? SHOW YOUR WORK HERE!

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W O R K S H E E T

On general information about the classes of levers.

Complete this exercise.

1. List the name that designates the three classes of levers.

   1.

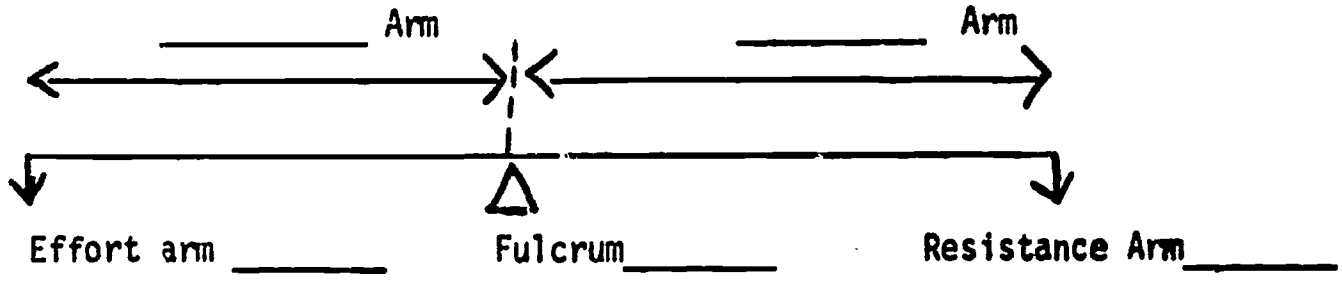
   2.

   3.

2. Levers are grouped into the three classes, depending upon the relative positions of the _____, _____ and _____.

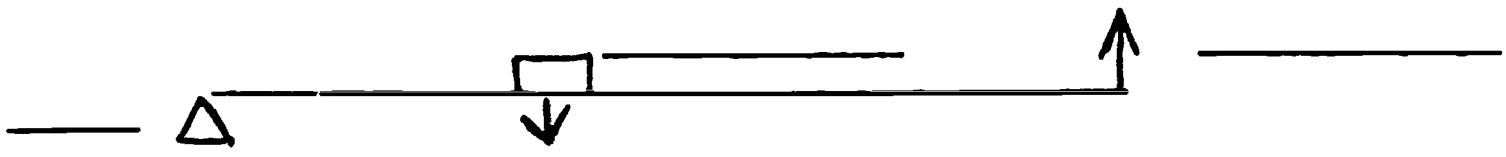
3. In the first class lever, the _____ is located at one end, the _____ is located at the other end, and the _____ is located somewhere between the effort and the resistance.

4. Label the following parts of a first class lever.



5. In the second class lever, the _____ and the _____ are on opposite sides and the _____ is located between the fulcrum and the effort.

6. Label the following second class lever.



7. In the third class levers, the _____ and the _____ are at opposite ends of the lever and the _____ is located somewhere between the fulcrum and the resistance.

8. Draw and label the third class lever.

Problems related to the Second Class Lever:

Draw the second class lever:

Does it resemble a wheelbarrow?_____

What part of the wheelbarrow resembles the fulcrum?_____

Where on the wheelbarrow will effort be exerted?_____

Where will the weight be exerted?_____

Again review the law of moment.

Problem: If 200 lbs. of weight is placed in a wheelbarrow and the distance from the wheel to the weight is 2 feet and the distance from the wheel to the handle is 5 ft., how much effort must be exerted on the handle of the wheelbarrow in order to lift the 200 lbs.? SHOW YOUR WORK HERE!

Consider the formula:

Clockwise torque = Counterclockwise torque

How much effort must be exerted on the handle of a wheelbarrow to lift 400 lbs. if the distance from the fulcrum (wheel) to the weight is 2 ft. and the distance from the wheel to the handle is 8 ft.? SHOW YOUR WORK HERE!

You will be required to solve similar problems on the Progress and LAP Tests.

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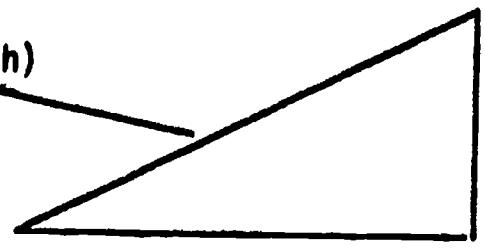
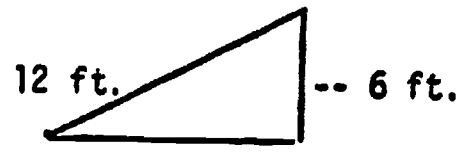
Simple Machines - Incline Plane



The incline plane is such a simple device that it scarcely looks like a machine at all. The average person cannot raise a 200 lb. box up 2 ft. But if you place a 10 ft. plank from where you are to lift the weight to the ground one can lift 200 lbs. easily. If there were no friction, one could lift the 200 lbs. by exerting only 40 lbs. of force.

The M. A. (Mechancial Advantage) of an incline plane is the length of the incline divided by the vertical rise.

Problems Related to the Incline Plane.



If man wanted to move a barrel weighing 200 lbs., how much effort would the man have to exert in raising the object this distance?

Ans. - 100 lb.

Solution: R X h = E X L

200 lb. X 6 ft. = E X 12 ft.
1200 ft/lb. = 12 E
100 lb. = E

The mechanical advantage of the incline plane is obtained by dividing the resistance by the effort.

$$MA = \frac{R}{E} = \frac{200 \text{ lb.}}{100 \text{ lb.}} = 2$$

Interpretation of Symbols:

R = resistance
H = height
E = effort
L = length
MA = mechanical advantage

Define mechanical advantage

Your problem - How much effort must be exerted in order to lift 400 lbs. up an incline plane that is 10 ft. long and 5 ft. high?
SHOW YOUR WORK HERE! What is the mechanical Advantage? _____

You will solve similar problems on the Progress and LAP Tests.

Simple Machines - General Information

1. What are the two basic parts of a pulley?_____

   and _____.

x 2. What are the two main kinds of pulleys?

   1. 2.

x 3. Differentiate between a movable and a fixed pulley.

x 4. What are some common uses of the fixed pulley?

5. What is a block and tackle?

x 6. What is a common use of a block and tackle?

7. What is a wheel and axle?

8. Name some common examples of the wheel and axle.

9. What is a wedge?

x 10. Give some common examples of wedges.

11. What is a screw?

12. Give some common examples of screws.

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x 13. What are some common uses for screws?

14. What does the terms effort and resistance mean in relation to machines?

effort-

resistance-

x 15. Interpret what is meant by the statement: "A machine has a mechanical advantage of 10."

x 16. To the physicist what is the meaning of the term efficiency?

17. What is the formula used to calculate the efficiency of a machine?

x 18. What is the meaning of the term friction?

x 19. How does friction effect a machine?

20. Differentiate between the terms work input and work output.

work input-

work output-

Self Evaluation

1. What is a lever?

2. Make a sketch of the three classes of levers.

3. What is the names of two different types of pulleys?
   1.
   2.

4. Give a common use for each of the following machines:
   1. lever
   2. incline plane
   3. fixed pulley
   4. wedge
   5. block and tackle
   6. screw

5. What information is given by the mechanical advantage?

6. In a scientific sense, what is meant by the following terms:
   1. efficiency
   2. friction
   3. work input
   4. work output
   5. effort

7. What formulas are used to solve problems relating to:
   1. mechanical advantage
   2. efficiency

8. That point on which a lever is supported and is free to rotate is called the (a) effort (b) resistance (c) fulcrum. circle one.

Self Evaluation (cont.)

9. A hammer is used to remove a nail from a board. The hammer would represent (a) first class lever (b) second class lever (c) third class lever. circle one.

10. A machine can never (a) save time (b) increase force (c) save work. circle one

PROBLEMS

1. How far from the fulcrum must a 150 lb. boy sit in order to balance a 75 lb. boy who sits 2 ft. from the fulcrum?

2. If a 300 lb. weight is placed 2 ft. from the fulcrum and the distance from the fulcrum to the handle is 5 ft., how much effort must be exerted in order to lift the 300 lbs.?

3. How much effort must be exerted in order to push a 150 lb. barrel up an incline plane which is 2 ft. and 3 ft. long?

4. What is the mechanical advantage in problem 3?

Section III

Work, Power and Energy

BEHAVIORAL OBJECTIVE I

Have you ever climbed a stairway lately? If so, estimate the amount of work you accomplished? _____ The amount of power? _____ If you can do this good! If not, you will be able to do so after you complete the activities for this section.

ACTIVITIES

_____ 1. Read pages 184-185

_____ 2. Define the term work in a scientific sense.

_____ 3. Write down the formula you would use to solve problems related to work.

_____ 4. Complete the enclosed worksheet on work.

_____ 5. What is meant by the terms power and horsepower.

_____ 6. Write down the formula you would use to solve problems related to power and horsepower.

_____ 7. Complete the enclosed worksheet.

_____ 8. Read and summarize pages 198-201 in the EPS textbook.

_____ 9. State the meaning for the following terms:

energy kinetic potential

_____10. Write down several examples for Kinetic energy and potential energy.

_____11. Write down the formula you would use to solve problems related to Kinetic and potential energy.

_____12. Complete the enclosed worksheets and problems related to potential and kinetic energy.

_____13. Complete the enclosed worksheet classifying conditions as either kinetic or potential energy.

_____14. Observe the filmstrip "Energy and Work" w/tapes

_____15. Complete the student activities on the worksheet.

1. Energy

Worksheet

1. What is the basic formula you use to solve problems relating to work?

PROBLEMS

1. A trunk weighing 150 lbs. rests on a floor. How much work is done when it requires a horizontal force of 45 lbs. to drag the trunk a distance of 20 ft. Answer____ _____

2. A boy weighing 130 lb. climbs an 8 ft. vertical ladder. Determine the amount of work done? Answer_____

3. If you lift a box weighing 60 lbs. through a distance of 10 ft. How much work do you do? Answer _____

You will further demonstrate your ability to solve similar problems on the LAP Test.

Worksheet

Problems related to Power

I. First write the formula necessary to solve problems related to power.

_____

Problems

1. A horizontal force of 110 lbs. is required to move an object across the floor a distance of 20 ft. in 8 seconds. What is the power required?_____

2. A boy weighing 130 lbs. climbs an 8 foot vertical ladder in 4 seconds. Determine the power required._____

3. If a man performed 10,000 ft. lb. of work in 5 minutes, how much power did he produce?

_____

Horsepower - The power developed by a machine is usually meausured in units called 1 HP - Horsepower(HP). In order to produce 1 HP, 33,000 ft.-lb. of work must be done in one second.

The following formulas are used to calculate the horsepower rating of an engine or machine.

w= work

(a) $HP = \frac{W}{T(min) \times 33,000} = \frac{f \times D}{T(min) \times 33,000}$

(b) $HP = \frac{W}{T(sec) \times 550} = \frac{f \times D}{T(sec) \times 550}$

Sample Problem:

A mass weighing 660 pounds was lifted a distance of 600 feet in 3 min. How much horse power was developed by the machine which did this job?

(a) $HP = \frac{660 \text{ lb.} \times 600 \text{ ft.}}{3 \text{ min} \times 33{,}000} = \frac{396{,}000}{99{,}000}$

or

(b) $HP = \frac{660 \text{ lb.} \times 600 \text{ ft.}}{180 \text{ sec.} \times 550} = \frac{396{,}000}{99{,}000} = 4 \text{ HP}$

Worksheet

Problems Related to Horsepower

1. An elevator lifts a weight of 528 pounds 1000 feet in 2 minutes. How much horsepower is produced by the motor? SHOW ALL WORK!

2. A mass weighing 1,320 lbs. was lifted a distance of 1200 ft. in 6 min. How much horsepower was developed by the machine which did the job. SHOW ALL WORK!

Worksheet

Problems related to Kinetic and Potential Energy

I. Write down the formula for calculating:

Kinetic energy _____

Potential energy _____

Problems:

1. What is the potential energy of a block which weighs 55 lbs., when placed on a ladder 10 feet from the ground?_____

2. Find the kinetic energy of a bullet weighing 0.15 lbs. if its speed of flight is 2,000 ft/sec. _____

3. A 10 bs. object moves with the speed of 25 ft/sec. Find the kinetic energy of the body. _____

4. What is the potential energy of a rock which weighs 100 lbs. when it is placed on a cliff 15 ft. high? _____

Worksheet

Classification of Forms of Energy

Kinetic ___?___ or Potential __?__

_____ 1. coiled spring

_____ 2. rock sitting on top of a cliff

_____ 3. dynamite explodes

_____ 4. unused battery

_____ 5. a running stream of water

_____ 6. heat energy

_____ 7. stick of dynamite

_____ 8. moving automobile

_____ 9. water behind a dam

_____10. energy within an atom

Definition:

kinetic energy:

potential energy:

Self Evaluation Section III

I. Briefly define the following terms:

1. work
2. power
3. energy
4. kinetic energy
5. potential energy

II. Classify the following as either kinetic or potential energy. Use a K for Kinetic and a P for potential energy.

_____ 1. dynamite explodes

_____ 2. water behind a dam

_____ 3. dynamite before it explodes

_____ 4. water running down a deep hill

_____ 5. rock sitting on top of a cliff

_____ 6. a coiled spring

III. What formula do you use to solve problems related to work._____

problems related to power_____

Solve the following problems

IV. A boy weighing 150 lbs. climbed a 4 ft. ladder in 4 seconds.
(a) How much work did he do? _____
(b) How much power? _____

V. What is the potential energy of a block which weighs 75 lbs. When it is placed on a ladder 5 ft. from the ground. _____ ft/lb.

VI. Find the kinetic energy of a 5 lb. object which moves with the velocity of 10 ft/sec.

_____ ft./lb. sec.

Advance Study

1. Make a display showing examples of some common levers we use everyday. Classify the levers as first, second or third class levers.

2. Prepare a report on one or more of the following topics.
   1. work
   2. power
   3. energy
   4. kinetic energy
   5. potential energy

3. Prepare a chart which lists the names of as many different kinds of energy as you can name.

4. Prepare a chart displaying the meaning for the terms kinetic and potential energy and five examples of each.

5. Prepare a display illustrating objects which change energy from one form to another(example - a toaster) changes electrical energy to heat energy, etc.

6. Prepare a chart which displays the three classes of levers with their different positions labeled.

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LEARNING ACTIVITY PACKAGE

INTRODUCTION TO CARBON

Ninety Six High School
Ninety Six, S.C.

SCIENCE 92

REVIEWED BY

LAP NUMBER 8

WRITTEN BY G. J. Williams

ERIC

R A T I O N A L E

Since carbon is one of the basic elements of matter, it is wise that this LAP consider this element in detail. How much do you already know about the element carbon?

How does carbon appear in nature? Are the following substances related to carbon in anyway, diamonds, graphite, petroleum and coal?

After completing this LAP, you will be able to answer these questions effectively. You will better understand the nature of the element.

Our next LAP will consider light and sound and how we hear and see.

Section I Properties and Manufactured Forms of Carbon

BEHAVIORAL OBJECTIVES:

After completing the activities for section I, you will be able to:

1. List the names, describe the appearance, and state the means of preparation for the given manufactured forms of carbon.

2. List four properties (ways to identify) the element carbon, this may include (color, texture, atomic number, atomic weight, etc.)

3. State a use for each of the following forms of carbon.

    1. Boneblack (animal charcoal)
    2. Carbon black
    3. Coke
    4. Charcoal (wood charcoal)

Activities for Section I:

1. Read and summarize the information covered on pages 81-86 in your textbook EPS.

2. Read pages 167-168 Book C of the World Book Encyclopedia 1970 edition Topics:
    1. Carbon
    2. Properties of Carbon
    3. Carbon Black

3. Define the following terms.

    1. coke
    2. charcoal
    3. lampblack
    4. carbon black
    5. boneblack
    6. hydrocarbon
    7. graphite
    8. diamond
    9. destructive distillation
    10. amorphous

4. Complete the following chart; refer to the references in activity 2.

Reference Chart on Carbon

Symbol_____ Atomic Weight_____

Atomic Number _____ Electron Arrangement_____

Crystalline Forms of Carbon

1. 2.

Amorphous Forms of Carbon

1. 3.

2. 4.

Description of Pure Carbon

1.

2.

How Pure Carbon can be Prepared

Four Common compounds which contains carbon.

Example: Carbon dioxide CO_2

1. 3.

2. 4.

5. Observe the demonstrations on how the following manufactured forms of carbon can be prepared. (As these forms are prepared record notes as they are given.)

   1. pure carbon
   2. boneblack
   3. charcoal
   4. coke

6. State two or more uses for the following:

   1. boneblack
   2. coke
   3. carbon black
   4. charcoal

7. Prepare a poster illustrating means of preparing at least four of the manufactured forms of carbon. This poster will be graded on content, completion of work, and getting the idea across.

Self Evaluation Section I

1. Describe the element carbon.

2. How can pure carbon be prepared?

3. List the names of two manufactured forms of carbon.

   1. 2.

4. Name and state a use for any two manufactured forms of carbon.

   1.

   2.

Complete the following:

5. _____ are compounds which are composed of only hydrogen and carbon.

6. _____ is the heating of a substance in the absence of air.

7. _____ is the amorphous form of carbon prepared by heating wood in the absence of air.

8. Classify the following as either amorphous (manufactured forms) or crystalline forms of carbon.

   1. boneblack _____
   2. diamond _____
   3. charcoal _____
   4. graphite _____

9. Name two compounds which contain carbon.

   1.

   2.

10. State how the following can be prepared in class.

   1. boneblack

   2. coke

   3. charcoal

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ADVANCED STUDY

1. Prepare a written report on either of the following topics:

    1. Amorphous Forms of Carbon
    2. Crystalline Forms of Carbon
    3. Carbon as an element
    4. Properties of Carbon

2. Prepare a display which illustrates

    1. Some amorphous forms of carbon
    2. Some crystalline forms of carbon
    3. Pure carbon

3. Demonstrate to the class how to prepare either or several amorphous forms of carbon.

4. Prepare a poster which displays some of the amorphous and/or crystalline forms of carbon and some of their uses.

Section II A Group of Carbon Compounds - Hydrocarbons

BEHAVIORAL OBJECTIVES:

One of the major groups of carbon compounds are the hydrocarbons. Hydrocarbons are compounds composed basically of the elements of hydrogen and carbon.

In this section of the LAP you will be concerned with how to determine the formula and the structural formula for three of the different series of hydrocarbons (alkan series, alkene series, and alkyne series.)

A. Given the basic formula; you will use this formula and determine the formula for some members of the alkane series. After you practice using the formula, you will be required to complete a chart using the correct formula for members of the alkane series.

Sample

Basic formula for determining the formulas for members of the alkane series.

$C_n H_{2n} + 2$ n = the number of carbon atoms

Example - If N = 4, 6, 8, determine the formula for the members of the alkane series.

N = 4	N = 6	N = 8
$C_n H_{2n} + 2$	$C_nH_{2n} + 2$	$C_nH_{2n} + 2$
$C_4H_{2(4)} + 2$	$C_6H_{2(6)} + 2$	$C_8H_{2(8)} + 2$
$C_4H_8 + 2$	$C_6H_{12} + 2$	$C_8H_{16} + 2$
$[C_4H_{10}]$	$[C_6H_{14}]$	$[C_8H_{18}]$

Your problems - If N = 1, 2, 3, 5, 7, 9 and 10. Determine the formula for the members of the alkane series of hydrocarbons.

Show your work here.

1. if n = 1
   formula _____

2. If n = 2

formula _____

3. If n = 3

formula _____

4. If n = 5

formula _____

5. If n = 7

formula _____

6. If n = 9

formula _____

Use this basic formula $C_nH_{2n} + 2$

Complete this Chart.

Members of the Alkane Series of Hydrocarbon.

N	Names	Formula
1	methane	CH_4
2	ethane	C_2H_6
3	propane	C_3H_8
4	butane	
5	pentane	
6	hexane	
7	heptane	

Name

8 octane

9 nonane

10 decane

Use this formula C_nH_{2n} + 2 just as you did on the preceeding page.

Example - C_nH_{2n} + 2

If n = 2

$C_2H_{2(2)}$ + 2

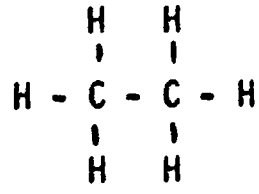
C_2H_6 (formula for ethane) look above.

B. Given examples and after the teacher explains how to go about constructing the structural formula for members of the alkane series, you will practice doing the structural formula for several assigned members of the alkane series. You will be required to do several structural formulas on the progress and the LAP Test.

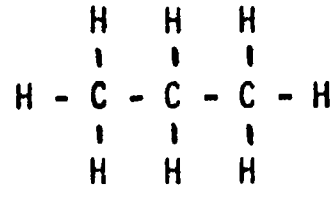
Examples:

Structural formulas for members of the alkane series.

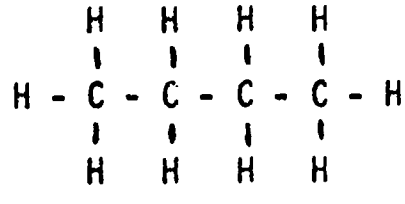
1. ethane C_2H_6 Structural Formula



2. propane C_3H_8 Structural Formula



3. butane C_4H_{10} Structural Formula



WORKSHEET

Structural Formulas for Alkane Series of Hydrocarbons

Do the structural formulas for the following hydrocarbons.

1. pentane — structural formula

   formula

2. hexane — structural formula

   formula

3. heptane — structural formula

   formula

4. octane — structural formula

   formula

5. nonane — structural formula

   formula

C. Given the general formula, you will use this formula and determine the formula for some members of another group of hydrocarbons called the alkene or the ethylene series of hydrocarbons. The general formula for the members of this series is C_2H_{2n}. Example: ethylene is the first member of the ethylene series, C_2H_4. The chief structural difference between the methane series and the ethylene series is that, in the ethylene series, a pair of carbon atoms shares a double bond.

Example - to determine the formula for members of the alkene series, use this general formula $C_n H_{2n}$.

If n = 2 Formula $C_2H_{2(2)}$ = ethylene

C_2H_4

If n = 3 $C_3H_{2(3)}$ = propane

C_3H_6

WORKSHEET

Calculating the formula for the alkene or ethylene series of hydrocarbons.

General Formula - C_nH_{2n}

n = 4 formula _____

n = 5 formula _____

n = 6 formula _____

n = 7 formula _____

n = 8 formula _____

n = 9 formula _____

n = 10 formula _____

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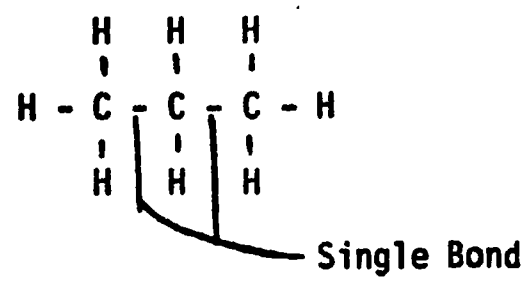
D. After studying the example given and listening to explanation given by your instructor, you will learn how to do the structural formulas for the alkene series of hydrocarbons. The basic difference between the structural formula for the alkane and alkene series is the members of the alkene series of hydrocarbons have double bonds.

Example of differences:

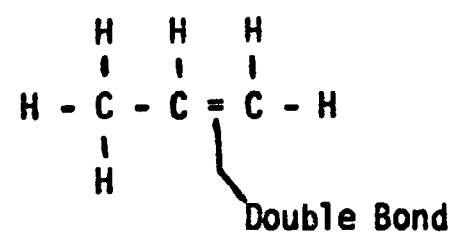
alkane series

propane C_3H_8



alkene series

propylene C_3H_6



E. Given the general formula, you will use this formula and determine the formula for some members of another group of hydrocarbons called the alkyne series of hydrocarbons or sometimes called acetylene series. In this series the carbon atoms and the general formula for determining the formulas for this series is $C_nH_{2n} - 2$. You will be required to determine formulas related to this on the Progress and the LAP Test.

Example: If n = 4, what is the formula for the hydrocarbon in the alkyne series?

Soultion:

n = 4 general formula $C_nH_{2n} - 2$

$C_4H_{2(2)}{}^{-2}$

$C_4H_8 - 2$

C_4H_6

If n = 5 $C_nH_{2n} - 2$

$C_5H_{2(5)} - 2$

$C_5H_{10} - 2$

C_5H_8

WORKSHEET

Determining the formulas for members of the Alkyne Series.

If n = 6 formula -

n = 7 formula -

n = 8 formula -

n = 9 formula -

n = 10 formula -

n = 11 formula -

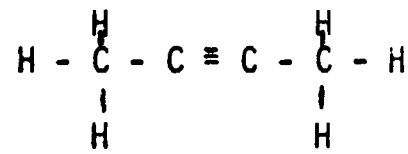
n = 12 formula -

F. After studying the examples given and listening to instructions from your teacher, you will be able to do the structural formulas for members of the alkyne series. Remember that the alkyne series have a triple (three) bonds between the carbon atoms. You will be required to do several structural formulas for members of the alkyne series on the Progress and the LAP Test.

Example: Construct the structural formula for the members of the alkyne series if n = 4.

formula - C_4H_6

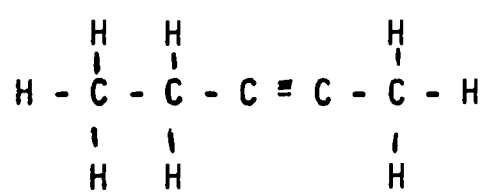
structural formula



if n = 5

formula C_5H_8

structural formula



WORKSHEET

Structural formulas for members of the Alkene Series.

Instructions:

Return to the worksheet where you calculated the formulas for the members of the alkene series. Using these same formulas, do the structural formulas for each of the hydrocarbons on that sheet.

	Formula	Structural Formula
1.		
2.		
3.		
4.		
5.		
6.		
7.		

Self Evaluation Section II

Compounds of Carbon - Hydrocarbons

Let N = 2, 4, 6, 8 and 10.

Using the appropriate formula for the appropriate series of hydrocarbons, determine the general and the structural formula for the

Alkane Series	Alkene Series	Alkyne Series
Formula		
Structural Formula		
Formula		
Structural formula		
Formula		
Structural Formula		
Formula		
Structural Formula		
Formula		
Structural Formula		

ADVANCE STUDY Section II

1. Prepare a report, using several references on general information about the hydrocarbons.

2. Prepare a write-up using several references about either one of the following series of hydrocarbons.

   1. Alkane Series
   2. Alkene Series
   3. Alkyne Series

3. Prepare a chart which displays the basic formula for determining the general formulas for each of the three series of hydrocabons.

4. Prepare a chart which displays the basic structures for determining the structural formulas for each of the three series of hydrocarbons.

5. Select a member from each of the three series and compare the properties and uses for the selected members.

Section III

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Diamonds and graphite

How much do you know about diamonds and graphite? Where are diamonds found? Graphite? What are some of their characteristics, properties, uses and differences.

BEHAVIORAL OBJECTIVES:

1. After completing the following activities, you will be able to state the following concepts about diamonds.

   a. General nature of diamonds
   b. Some uses, properties and means of preparation
   c. Briefly how diamonds are formed in nature
   d. The meaning of some terms related to the study of diamonds

2. You will be able to state the following concepts related to the study of graphite.

   a. The general nature of graphite
   b. Some uses, properties, occurances and producers of graphite
   c. Method of preparation
   d. How graphite is related to the study of the element carbon

Activities for Section III:

1. Read pages 147-150 of the World Book Encyclopedia, Volume D, under the topic "Diamond."

2. Complete the enclosed worksheet on diamonds and learn the answers to those with an X mark by them.

3. Prepare a report on one of the following topics related to the study of diamonds.

   (1) How Diamonds Are Cut to Make Jewels
   (2) How Diamonds Can be Judged
   (3) What Diamonds Are
   (4) Where Diamonds are Found

4. Look up the definition for the terms related to diamonds and become familiar with them.

5. Read page 315 of the World Book Encyclopedia, volume G, under the topic "Graphite."

6. Complete the enclosed worksheet on graphite and learn the answers to the questions with an X by them.

7. Take the Self Evaluation.

8. Prepare an advance study.

9. Go to Section IV.

WORKSHEET ON DIAMONDS

Complete this Exercise:

X 1. Diamonds may be used in industry for.

(a)

(b)

(c)

X 2. Diamonds are crystals formed almost entirely of _____ .

3. The only other material that can scratch a diamond is _____.

X 4. A diamond (will, or will not) dissolve in an acid?

X 5. A diamond (can, or cannot) be destroyed with intense heat?

X 6. If diamonds are heated in the presence of oxygen, the compound, _____ is formed.

7. If diamonds are heated in the absence of oxygen,_____ is formed.

8. The fact that diamonds are _____ makes them expensive.

9. _____,_____, and_____ are three places in the world that the important diamond fields may be found.

X 10. _____ is the country that produces 90% of the world supply of diamonds.

11. Most diamond looks _____ when taken from the ground.

X 12. The size of diamonds are determined by _____ in _____.

13. Gems, diamonds are graded according to:

(a) (c)

(b) (d)

X 14. Flaws in diamonds might be due to:

a. c.

b. d.

X 15. Briefly tell how man-made diamonds are made.

16. One of the reasons why diamonds are so expensive is because _____ and _____ the rough diamond is a _____ and _____ process.

17. About _____ percent of the diamonds are only suitable for industrial use.

X 18. Scientists believe that diamonds were formed millions of years ago when _____ was subjected to great heat and pressure.

19. _____ and _____ transforms rough diamonds into sparkling gems.

20. _____ and _____ are two colors which diamonds might appear.

Terms Related to the Study of Diamonds:

Define these terms:

X 1. diamond

2. facets

3. carat

X 4. flawless diamond

X 5. perfect diamond

X 6. man-made diamonds

X 7. natural diamonds

8. gem

X 9. polished diamonds

10. cut diamonds

WORKSHEET ON GRAPHITE

X 1. Graphite occurs in nature as a _____, _____, _____, that is _____ to the touch.

2. How is most of the graphite that is used today made?

X 3. Graphite mixed with clay and hardened is what the _____ in our pencils are made of.

X 4. List four properties of graphite.

a.

b.

c.

d.

X 5. List four uses for graphite.

a.

b.

c.

d.

X 6. Can graphite be used as one of the raw materials in making man-made diamonds?

X 7. Both diamond and graphite are made up of _____ carbon.

X 8. What accounts for graphite being so soft?

9. Graphite occurs in _____ states in the United States.

10. _____ is the only state that produces natural graphite.

11. _____ developed the process for making graphite from coke in the year _____.

12. _____ is the leading producer of manufactured graphite.

Self Evaluation. **Section III**

1. List two uses for diamonds.

   1.

   2.

2. Name the element that is a basic part of diamonds.

3. Name the gas that is formed if diamonds are heated in the presence of oxygen._____.

4. What is formed if diamonds are heated in the absence of oxygen.

5. Can a diamond be destroyed with an acid? _____ intense heat?____

6. How does graphite differ from diamond?

7. How are graphite and diamonds related?_____

8. What can graphite be used for?

9. List two properties of graphite.

   1. 2.

10. What accounts for the fact that graphite is soft and diamonds are hard?

11. Classify diamonds and graphite as either amorphous, or crystalline forms of carbon._____

12. How can diamonds be made by man?
    Can graphite be used to make diamonds?

ADVANCED STUDY Section III

1. Prepare a chart which displays the similarities and differences between diamonds and graphite.

2. Prepare a detailed report on either diamonds or graphite use and list several different references.

3. Prepare a summary of how the General Electric Company went about making the first man-made diamond.

4. Prepare a chart contrasting the uses for diamonds and graphite.

5. Prepare a pictorial display of some of the products or uses we enjoy due to diamonds or graphite.

Section IV

Petroleum and Coal - Resources Related to Carbon.

BEHAVIORAL OBJECTIVES:

1 A. Petroleum

After completing the prescribed activities, you will be able to state.

1. The names of some of the instruments used to detect and transport oil deposits.
2. Some of the useful products we can obtain from petroleum.
3. The theory which best explains how petroleum originated.
4. The meaning of some terms which are related to the study of petroleum.
5. The names of the two basic elements.
6. How petroleum is broken up into useful products.

1 B. Coal

1. How coal is formed (stages of development)
2. Four basic kinds of coal.
3. Some useful products obtained from coal.
4. The basic difference in nature and uses for anthracite and bituminous coal.
5. Basically where coal is found in the United States.
6. What we can get from a ton of coal (by- products)

Activities 1 A.

1. Read and summarize the information given in the World Book Encyclopedia, Volume P pages 292-312.
2. Complete the enclosed worksheet using the World Book Encyclopedia Volume P pages 292-312. (Learn the answers to those with an (X) by them.
3. Define the following terms which are related to the study of petroleum.

Terms related to the study of petroleum:

1. petroleum
2. crude oil
3. Christmas tree
4. magnetometor
5. gravity meter
6. fractional distillation
7. hydrocarbon
8. fractionating tower
9. gasoline
10. kerosene
11. seismograph
12. refining

4. State the names of three instruments which can be used to detect oil deposits and how they operate.

5. Make a poster on either of the following diagrams from the World Book Encyclopedia.

   1. Refining Petroleum (page 306 - Book P)

   2. What a Barrel of Crude Oil Provides (page 296 Book P at the top).

Coal 1 B.

1. Read pages 566-581 in Book C of the World Book Encyclopedia. (You may use the reprint for this)

2. Complete the enclosed Worksheet on Coal (Use A reprint from the World Book Encyclopedia - Coal)

3. List the names and the descriptions for the four basic stages in the development of coal.

4. Write down a summary of "How Coal Was Formed: (Reprint pages 566-577).

5. State the difference between anthractie and bituminous coal (description and uses). (reprint page 568)

6. State where coal is basically found in the United States. (reprint pages 577-578)

7. List twenty products we can obtain from a ton of coal. (reprint p. 580)

8. Make a poster from the title "Black Magic" ideas may be obtained from page 583 of the reprint.

WORKSHEET

Petroleum - General information about petroluem.

X 1. _____ is the state that produces 70% of our petroleum.

X 2. _____ is the man who dug our first oil well in the year _____ in the state of _____.

3. _____, _____, and _____ are three instruments that can be used to detect oil deposits.

X 4. List five products that might be obtained from petroleum.

(a) (d)

(b) (e)

(c)

X 5. Why is petroleum called black gold?

X 6. Name one important fuel that might be obtained from petroleum.

7. Name four devices used to move the oil.

(a) (c)

(b) (d)

8. _____ carry more petroleum than do any other means of transportation.

X 9. No one really knows how petroluem was formed. However most scientist accept the organic theory. State the theory.

10. _____ is the biggest user of oil in the world.

X 11. Petroleum is composed of thousands of different combinations of just two elements_____ and _____.

X 12. Oil refineries breaks petroleum down into various _____ by means of _____.

WORKSHEET

Coal - General Information about Coal

1. _____ is the most important use for coal.

2. _____ is a use for coke.

3. Coal is sometimes referred to as _____ _____.

4. _____, _____, _____ and _____ are the four basic stages in the developemtn of coal.

5. Name ten products we can obtain from a ton of coal.

1.	6.
2.	7.
3.	8.
4.	9.
5.	10.

6. How is coal grades?

7. Coal originates from _____.

8. What is meant by carboniferous period?

9. State a difference between, anthracite coal_____

and bituminous coal_____.

10. Complete the following information "Burning 100 pounds of coal helps in the manufacture of:

_____ pounds of cement

_____ pounds of newspaper

_____ pounds of aluminun

_____ pounds of steel

Self Evaluation Section IV

1. Is petroleum and crude oil about the same thing?

2. Name four products we can obtain from petroleum.

3. Name and state the use for three instruments used to detect oil deposits.

   1.

   2.

   3.

   4.

4. What is the name of the theory which best explains how petroleum originates?

5. In the transportation of crude oil what is a Christmas tree used for?

6. What is the names of the two basic elements of which petroleum is composed?

7. Briefly define the following terms.

   1. fractional distillation

   2. fractionating tower

   3. refining

   4. hydrocarbons

8. Briefly explain how coal is formed in nature.

Self Evaluation (cont.)

9. Name the four basic stages in the formation of coal.

   1.

   2.

   3.

   4.

10. Name four products we can obtain from coal.

   1. 3.

   2. 4.

11. Name the basic use of coal.

12. State the names of two states where coal can be found in the United States.

   1. 2.

13. What is a basic difference between

   1. Anthracite coal_____

   2. Bituminous coal_____

14. What is meant by carboniferous period?

15. Is coal being formed in South Carolina?

ADVANCE STUDY

Section IV

1. Write a brief history on the Origin and Nature of Petroleum.

2. Prepare a chart displaying some of the yeilds from a barrel of crude oil.

3. Select one of the following topics and prepare a report using several different references:

   1. The Petroleum Industry Today
   2. Searching for Oil
   3. Drilling for Oil
   4. Producing Oil
   5. Transportation of Crude Oil

4. Prepare a poster which displays a Fractionating Tower and explain what goes on during the Fractional distillation process of petroleum.

5. Select one of the following topics and do some research using several references:

   1. Time of Formation of Coal
   2. How Coal is Mined
   3. How Coal is Transported
   4. Products From Coal

6. Prepare a poster which displays a graph which shows either and/or the following:

   1. Uses of Bituminous Coal
   2. Leading Coal Mining States
   3. Leading Coal Mining Countries

7. Prepare a map and indicate where the main coal deposits occur in the United States (Use different colors to indicate

   (a) bituminous
   (b) lignite
   (c) anthracite

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LEARNING ACTIVITY PACKAGE

HOW WE SEE AND HEAR

Ninety Six High School
Ninety Six, S.C.

PHYSICAL SCIENCE 92

REVIEWED BY _____

LAP NUMBER 9

WRITTEN BY G. J. Williams

R A T I O N A L E

Light provides us with most of the information about surroundings. It is not surprising therefore, that man has given much thought to the behavior of light and to methods of controlling. As a result, we now have thousands of devices invented to produce light in dark places, to improve vision, and to preserve images for later study.

Much of our information about the world comes to us throught our ears. Hearing is especially important for communication with others.

Sounds tell much more than people realize. A mechanic knows when an engine needs adjustment by listening to it. A Biologist identifies many birds, frogs, and insects by their songs and calls. An outdoorsman predicts weather by the noise of the wind.

We will study these and other concepts in more detail in this LAP.

BEHAVIORAL OBJECTIVES:

(IA) 1. Using the prescribed resources, you will be able to:

1. Define given related terms to the study of the eye.
2. State the names and function of given parts of the eye.
3. Trace the path of light from the outer eye to the brain.
4. State the general nature and cause of given eye defects.
5. State generally how given eye defects may be corrected.

Activities:

1. Define the following terms:
   1. optic nerve
   2. ophthalmologist
   3. eye
   4. nearsightedness
   5. farsightedness
   6. astigmatism
   7. cross eyedness
   8. ophthalmology
   9. color blindness
   10.

2. Give the function for each of the following parts of the eye:

1. Iris	6. optic nerve	11. watery fluid
2. pupil	7. brain	12. vitreous fluid
3. cornea	8. rods	13. eye lids
4. lens	9. cones	
5. retina	10. eye	

3. Study the transparency on the parts of the eye (if necessary you may make a sketch.)

4. Arrange the following in order (from the time light enters the outer eye until it reaches the brain):

1. optic nerve	6. vitreous fluid
2. pupil	7. cornea
3. lens	8. brain
4. iris	9.
5. retina	10. watery fluid

5. Use the World Book Encyclopedia and/or the dictionary, Pathways in Science (Sound and Light) and give brief explanations for the nature, cause and means of treatment for the following eye defects:
   1. astigmatism
   2. nearsightedness
   3. farsightedness
   4. color blindness
   5. cross eyedness

Additional Resources:

Transparency: The Eye

Work Sheet: The Eye

Filmstrips: How we See
The Eye and the Camera

(IB) 1. Using the prescribed resources you will be able to:
   1. State brief definitions for given terms related to the study of light.
   2. State the rate at which light travels through space (contrast this with the ratio at which sound travels through space).
   3. State the difference between the following in relation to the path of light:
      1. transparent
      2. opague
      3. translucent
   4. Name the basic source of light in the universe and its significance.
   5. Name and state the difference between some natural sources of light and some artificial sources of light.
   6. State the difference between reflection and refraction of light.

Activities for section I (IA)

1. Define the following terms:
   1. light
   2. reflection
   3. refraction
   4. transparent
   5. opague
   6. translucent
   7. radiant energy
   8. beam (of light)
   9. ray (of light)
   10. photo trophism
   11. optical illusion
   12. luminous
   13. incandescent
   14. illuminated

   Resource for 1-14: Dictionary

2. State the difference between the rate at which light travels through space and the rate that sound travels through space.
   Resources:
   1. Pathways in Science (Sounds and Light)
      Topics: (1) The Travels of Light p. 95
              (2) The Travels of Sound p. 29-30
   2. The Physical World
      Topics: (1) The Speed of Sound p. 494-497

3. Differentiate between the following terms:
   1. transparent
   2. translucent
   3. opague

   Resources: Pathways In Science (Sound and Light)
   Topic: (1) When Light Strikes an Object p. 89-90

4. Name the basic source of light in our universe.
   Resources: The World Book Encyclopedia Vol. 12-Book L
   Topic: (1) Sources of Light

Activities for Section I (cont.)

5. Name and state the difference between some natural sources of light and some artificial sources of light.
   Resources: The World Book Encyclopedia Vol. 12 Book L Pages 250-255

6. State the difference between reflection and refraction of light.
   Resources: Science--A Key To The Future Refraction page 176-177
   Pathways In Science (Sound and Light)
   Topics: 1. Light Bounces Back pp. 91-92
   2. The Travels of Light p. 95
   3. When Light Looks Back p. 111-113
   World Book Encyclopedia-Vol. 12 Book L
   Topics: 1. The Nature of Light p. 248
   2. Reflectors and Refractors p. 253

7. Complete the following given worksheets related to the study of light:
   1. What is Light (Complete the Worksheet)
   2. Nature of Light (Complete the Worksheet)
   3. Sources of Light (Complete the Worksheet)
   4. Reflection of Light (Complete the Worksheet)
   5. Refraction of Light (Complete the Worksheet)

Filmstrips:

1. Light
2. Light In Our Home

SELF-EVALUATION

1. State a brief definition for the following terms:
   1. Ophthalmologist
   2. Astigmatism
   3. Nearsighted
   4. Color blindness
   5. Eye
2. State the function for each of the following parts of the eye:
   1. Optic nerve
   2. Rods
   3. Cornea
   4. Pupil
3. Briefly explain the nature of the following eye defects:
   1. Nearsightedness
   2. Astigmatism
   3. Crosseyedness
4. Trace the path of light from the outer eye to the brain.
5. Which travels fastest, light or sound? _____
6. Does light need a medium through which to travel? _____
7. Will light travel through a vacuum? _____
8. Name one of each of the following:
   1. transparent materials _____
   2. opague materials _____
   3. translucent materials _____
9. Name the basic source of light in our universe. _____
10. What are two things that would probably happen if the sun would suddenly stop shining?
    1.
    2.
11. Name two artificial sources of light.
    1.
    2.

Self-Evaluation (cont.)

12. What is the difference between the following terms:
    1. Reflection of light

    2. Refraction of light

13. What is the difference between the following?
    1. Transparent material

    2. Translucent material

14. Classify the following as either transparent, translucent, or opague substances:

    1. water _____
    2. frosted glass _____
    3. wax paper _____
    4. air _____
    5. aluminum _____

ADVANCE STUDY
Section I

1. Prepare an exhibit of materials that are opague, transparent and translucent.

2. Make a study of the human eye and its operation.

3. Make a booklet illustrated with pictures telling the story of the famous Mt. palomar telescope in California.

4. Make charts and models to explain the nature of eclipses of the sun and moon.

5. Prepare a poster contrasting the names and pictures of some artificial and natural sources of light.

6. State the general characteristic and names of some good reflectors and poor reflectors of light.

7. Explain what causes a rainbow to form.

Section II

BEHAVIORAL OBJECTIVES:

(IIA) Using the prescribed resources you will be able to:

1. Define terms related to the study of the ear.
2. State the names and function of given parts of the ear.
3. Trace the path of sound from the outer ear (auricle) to the brain.
4. State the difference between audible and inaudible sounds and give several examples of each.
5. State the relationship of the following terms to the study of sound:
   1. microphone
   2. megaphone
   3. stethoscope
   4. acoustics
   5. oscilloscope
6. State how we are able to prcduce sounds with our vocal organs.

Activities:

1. Define the following terms;
   1. ear
   2. auditory nerve
   3. eardrum
   4. ultrasonics
   5. acoustics
   6. sounds
   7. sonar
   8. noise
   9. loudness
   10. decibel

   Reference: Use the dictionaries and the glossary of the resource books.

2. Tell for what each of the following parts of the ear are used:
   1. auricle
   2. auditory canal
   3. eardrum
   4. hammer
   5. anvil
   6. stirrup
   7. the oval window
   8. the cochlea
   9. organ of corti
   10. auditory nerve
   11. brain
   12. semicircular canals

   Resources for Activity 2:
   1. Modern Physical Science
      Topics: (1) The Sensation of Sound is Produced in the Brain p.289
   2. The Physical World
      Topics: (1) How We Hear p. 500-504
   3. Pathways In Science (Sound and Light)
      Topics: (1) The Human Ear p. 34-35

3. Arrange in order the path sound travels from the outer ear to the brain.
   1. Brain
   2. Auricle
   3. Auditory nerve
   4. Auditory canal
   5. Stirrup
   6. Hammer
   7. Anvil
   8. Oval Window
   9. Organ of Corti
   10. Cochlea
   11. Eardrum

   Resources for Activity 3:
   1. Notes from teacher (lecture)
   2. Basically the same resources as for activity 2.

4. Define the terms audible and inaudible. List several sounds that are classes as audible sounds and several which are in audible.
   Resources for Activity 4:
   1. Science: A Key to the Future
      Topics: Effect of a Vacuum on Sound p. 124
   2. Pathways In Science (Sound and Light)
      Topics: 1. Sounds of our World p. 23
              2. The Travels of Sound p. 29-30
              3. How fast Sound Travels p. 30

5. State the relationship between the following terms and sound:
   1. microphone
   2. megaphone
   3. stethoscope
   4. acoustics
   5. oscilloscope

   Resources for Activity 5:
   1. Pathways In Science (Sound and Light)
      Topics: 1. "Lets show it on An Oscilloscope" p. 49 & 26
              2. Glossary p. 76-81

6. Explain how we are able to produce sound with our vocal organs
   Resources for Activity 6:
   1. Pathways In Science (Sound and light)
      Topics: 1. The Human Voice pp. 40-41
   2. Exploring Physical Science
      Topics: 1. Vocal Cords pp. 234-235

Additional Resources:

Handouts:

1. Diagram of the ear to lable parts and to state function of the parts
2. Diagram to trace the path of sound from the outer ear to the brain.

Tapes and Audio Visuals:

1. Wallensah Teaching Tape-C-7058:"How We Hear". Complete Worksheet.

Film and Filmstrips: How We Hear.

Worksheets:

1. Man's Voice
2. Animal sounds and Hearing

Section III

BEHAVIORAL OBJECTIVES:

(IIIB) 1. After completing the following activities you will be able to:
   1. Define terms related to this section of the LAP on sounds.
   2. Briefly state how sound is produced and how sound travels and the general nature of sound.
   3. State the names of four different kinds of sounds.
   4. Contrast the different rates at which sound travels through different materials.
   5. State the meaning and cause of echoes and multiple echoes.
   6. State the nature, cause and some uses for ultrasonic sounds.

Activities:

1. Define the following terms:
   1. acoustics
   2. frequency
   3. pitch
   4. loudness
   5. noise
   6. decibel
   7. vibration
   8. echoes
   9. sonar
   10. ultrasonics
   11. sound

   Resources: The dictionary and the glossary of the books found on the cart.

2. State how sound is produced and how sound travels and the general nature of sound.

   Resources: (1) Wollensak Teaching Tape C-7550 The Nature of Sound
   Complete the Worksheet.
   (2) Film: Sound. Complete the questions after section I and section II.
   (3) Pathways In Science (Sound and Light)
   Topics: 1. Where there is Sound There is Motion p. 498-499
   2. The Travels of Sound p. 29-30
   3. How Fast Does Sound Travel p. 30
   (4) The World Book Encyclopedia Book S
   Topics: 1. What is Sound .p. 488
   2. How Sound Travels p. 489
   3. Characteristics of Sound p. 489
   4. Sound Travels at Different Speeds p. 491

3. State the names of several different kinds of sound.
   Resources: (1) The World Book Encyclopedia Book S
   Topic: Kinds of Sound p. 493
   Worksheets: Complete activities
   1. What is Sound?
   2. Nature of Sound

4. Contrast (state the difference) the different rates that sound travels through different materials.
   REsources: (1) Pathways In Science (Sound and Light)
   Topics: 1. The Travels of Sound p. 29-30
   Chart to complete on "The rate that Sound Travels Through different materials.
   Worksheet to complete student activities:
   1. Sound and Materials

5. State the meaning and cause of echoes and multiple echoes.
   Resources: (1) Pathways in Sound (Sound and Light)
   Topics: When Sound Reaches a Surface and Bounces Back
   p. 31-32

6. What is the meaning of and some uses for ultrasonic sounds?
   Resources: (1) Pathways In Science (Sound and Light)
   Topic: Bats and A new Science p. 36

SELF-EVALUATION

1. Briefly define the following terms:
   1. auditory nerve

   2. ultrasonics

   3. acoustics

   4. echo

   5. megaphone

2. State the function for each of the following parts of the ear.
   1. auricle

   2. auditory canal

   3. auditory nerve

   4. brain

3. List in order the eleven steps tracing sound from the outer ear to the brain.

4. What is the difference between audible sounds and inaudible sounds.

5. State briefly what the following are used for:
   1. oscilloscope

   2. stethoscope

   3. megaphone

   4. microphone

6. Sound travels in the form of _____.

7. Briefly state how man is able to produce sound using his vocal organs.

8. Name two animals which produce ultrasonic sounds.
   1. 2.

9. How does a cricket produce sounds?

10. What are two different kinds of sound?
    1.

    2.

11. What causes an echo?

12. What are some uses for ultrasonic sounds?

13. Arrange in order from fastest to slowest the rate at which sound will travel through the following:

1. Gas	1.
2. Solid	2.
3. Liquid	3.

14. State why sound travels faster through some substances and objects than it does through others.

15. Why is it that you see lightning before you hear thunder even though they both occur at the same time?

16. Which travels faster light or sound?

17. Which needs a medium through which to travel-light, sound, or both?

18. What is the scientific study of sound called?

19. Why are sounds louder in an empty room than in a room which contains carpet, bedspreads, and curtains, etc?

20. Sound travels in the form of _____.

ADVANCED STUDY

1. Make a poster displaying a diagram of the ear with labeled parts and state the function of each part.

2. Do some research on ear defects and their causes. (Deafness)

3. Find out why some ceiling tiles have holes in them.

4. Prepare a chart which displays some samples of loudness of sounds. Reference: Pathways In Science (Light and Sound) p. 49

5. Make a chart which illustrates how several animals produce sounds and how they are able to hear sounds.

6. Find out how the porpoise and the bat are able to detect sounds.

7. Find out how ultrasonic sounds are used in industry and in medicine.